THE JOURNAL OF GAS LIGHTING
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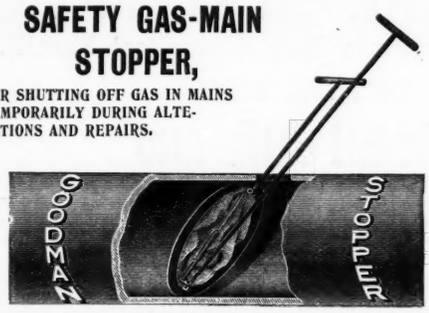

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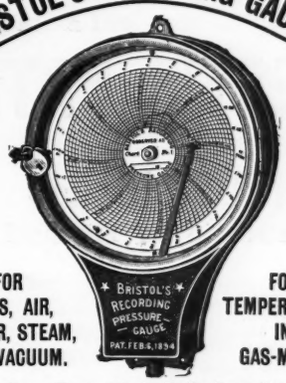

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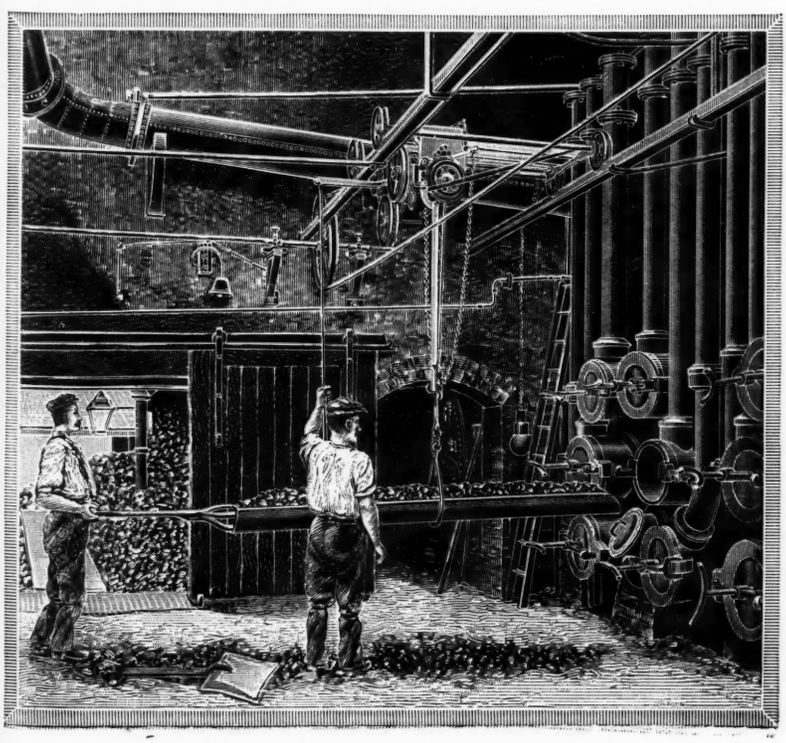

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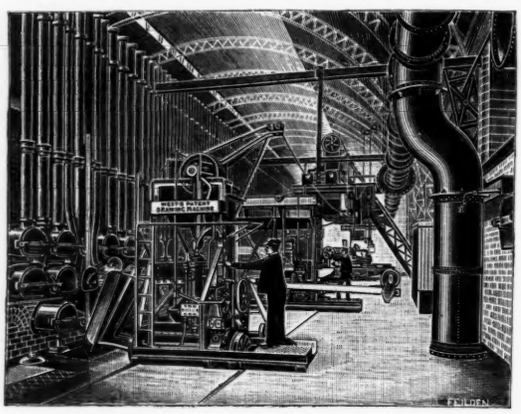

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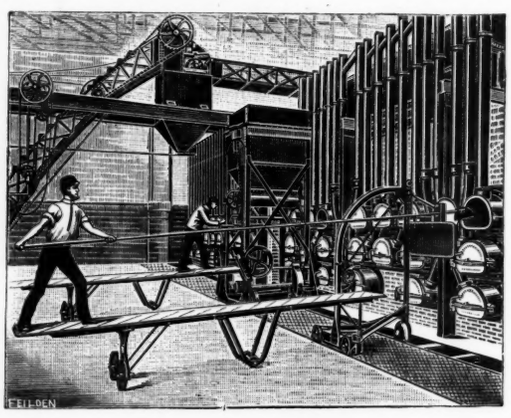

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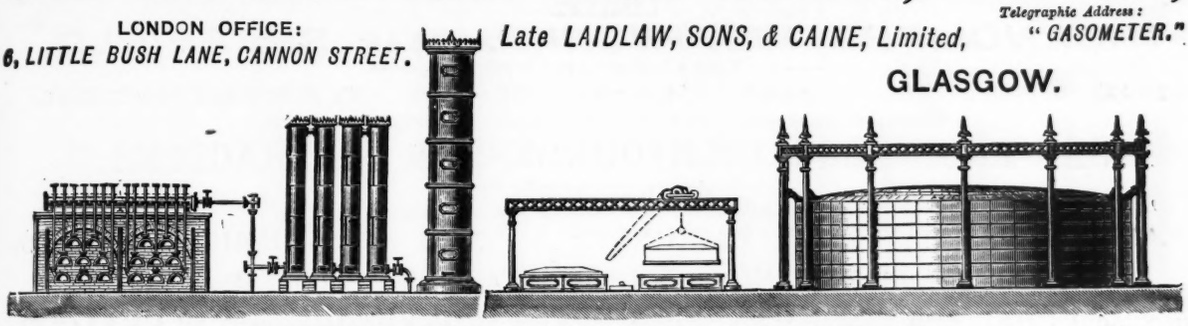

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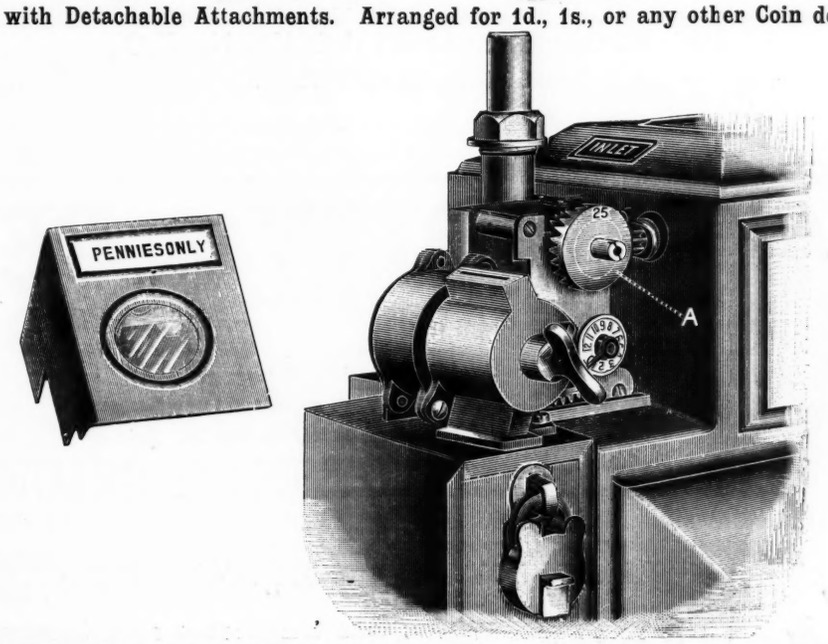

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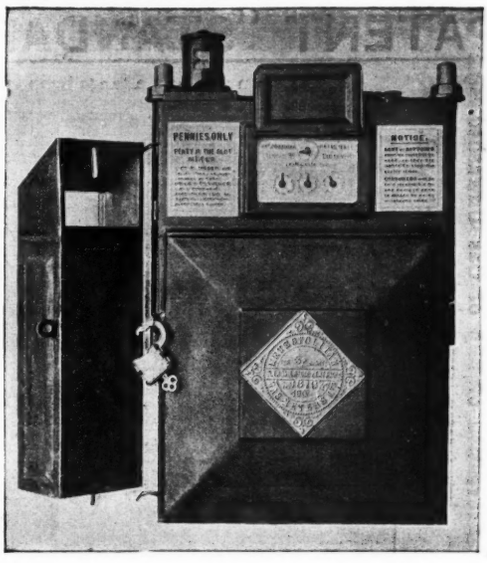

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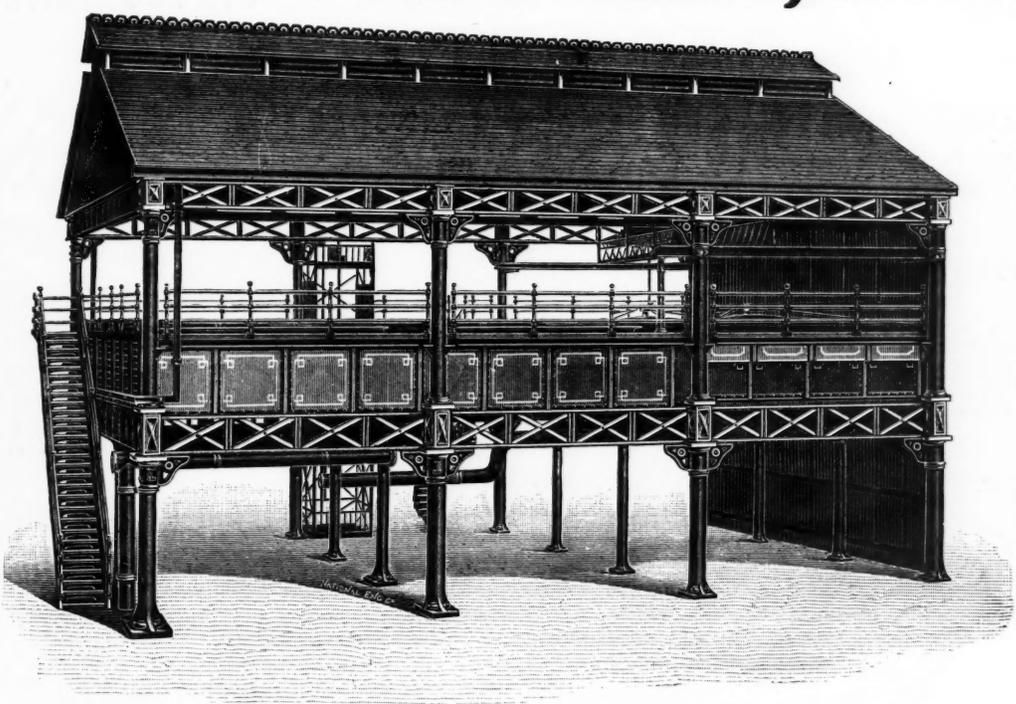

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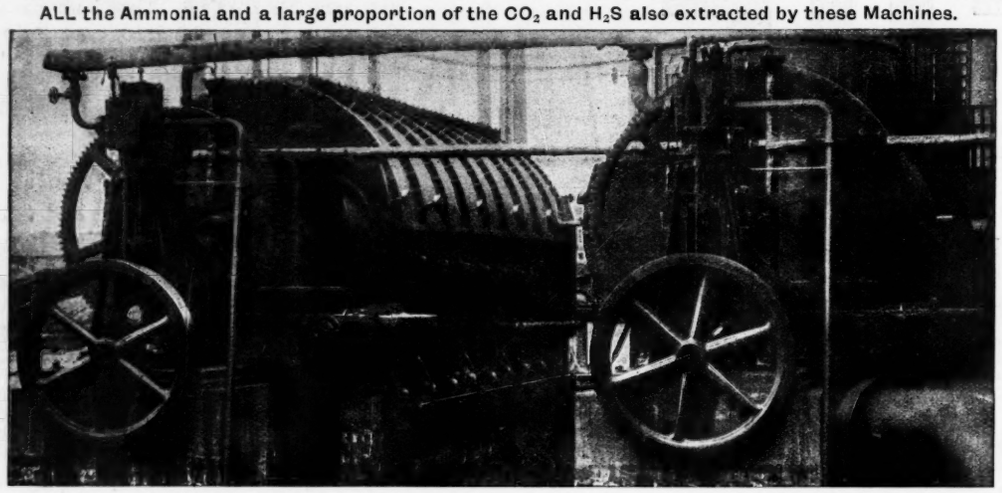

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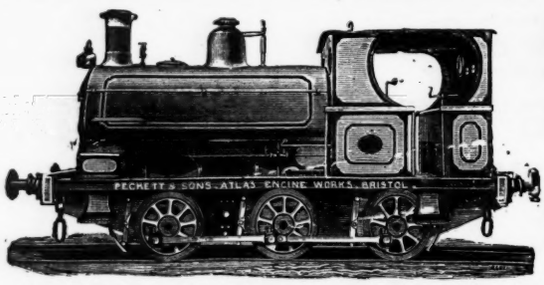

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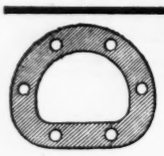

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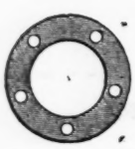

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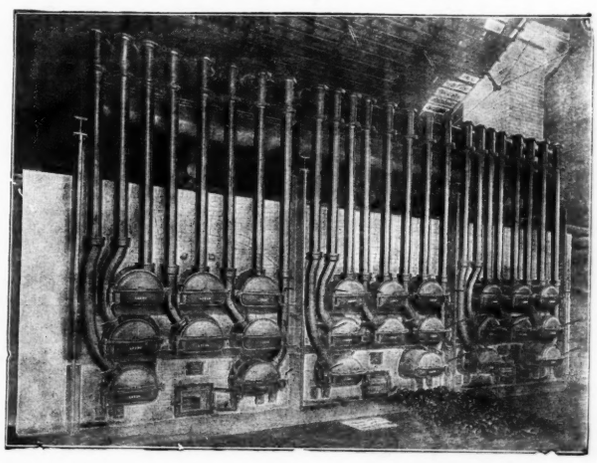

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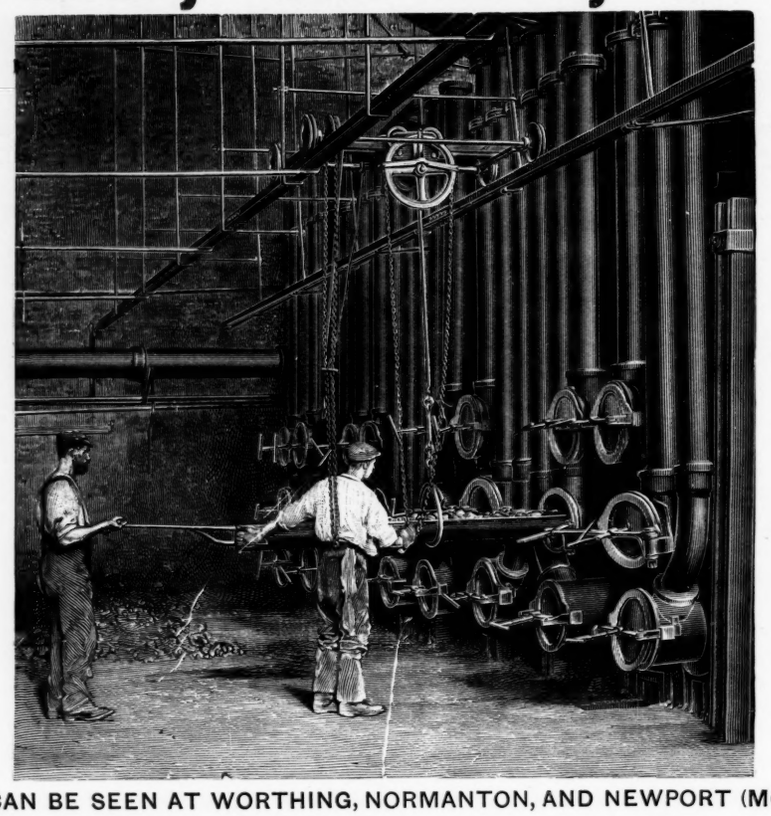

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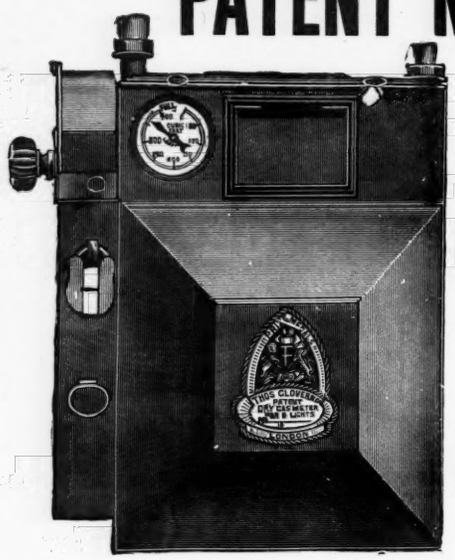

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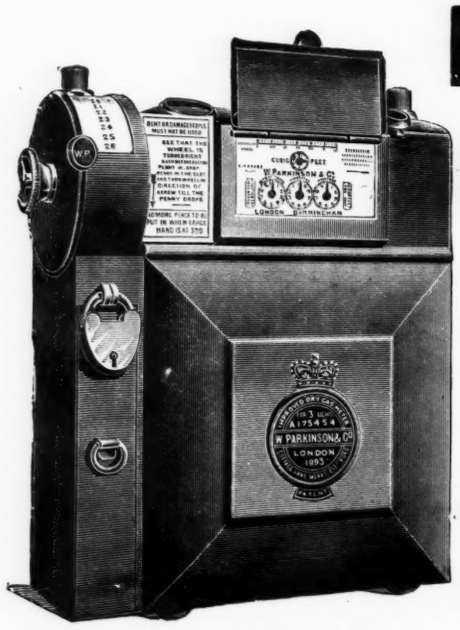

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EDITORIAL NOTES.

Mr. Foulis on the Economics of Gas Manufacture, and Gas-Engine Power.

IN his capacity of President of the Institution of Engineers and Shipbuilders in Scotland, Mr. W. Foulis, of Glasgow, delivered the interesting address reported elsewhere. It is not often that Mr. Foulis opens his mouth in this way; but whenever he does venture to speak as a specialist, he is well worth hearing. Dealing with the state of the gas industry, which is continually growing, Mr. Foulis remarked that in Glasgow this expansion is so incessant and considerable that additional and always larger works are continuously in course of construction. Gas engineers have to look farther ahead than ever, to make the necessary provision for the increasing public demand for gas—not only in Glasgow, but almost everywhere else. Glasgow, however, owing to the liberal policy of the Gas Commissioners, feels very quickly the impulse of the popular appreciation of gas. Descending at once into the particulars of his craft, Mr. Foulis discussed the conditions of gas manufacture by carbonization. He said a favourable word for the idea of carbonizing in greater bulk than is ordinarily the practice, but did not carry the subject far. He insisted upon the importance of maintaining gas-retorts uniformly at a carbonizing temperature of about 2000° Fahr., which in his case enables three-hour charges to be the rule of retort-house practice. He condemned the carburetting of coal gas as obsolete.

We are very loth to suggest a correction of Mr. Foulis's statements; but he is wrong in ascribing the regenerative gas-burner to the late Sir W. Siemens. The inventor of this method of burning gas for lighting purposes, after its success had been established in the case of fuel gas, is Mr. Frederick Siemens, of Dresden, still happily spared to the world. Mr. Foulis passed on to describe the Welsbach method of using gas for lighting; and he fully recognized the character of the change which the extended use of the incandescent system of lighting will have in the near future on the manufacture of gas. Although it is, of course, true, Mr. Foulis must have given some of his audience pause for reflection when he reminded them that all coal burning is as much gas making as anything effected in a gas-works. Just as carbonizing coal at a high heat makes most gas and less condensable products, so stoking a boiler fire in small quantities, at a full furnace heat, is far better practice and makes less smoke than the usual imperfect, lazy fashion of piling on the coal anyhow. Mr. Foulis did ample justice to Mr. Frederick Siemens as the originator of the principle that flames of gas should not be allowed to come into contact with cold surfaces, but should burn themselves out in a free space.

Mr. Foulis ventured to predict that the gasification of coal in producers will come more and more into general use for heating purposes, until, before many years of the new century have passed, the time will have arrived when a furnace burning raw coal will seldom be seen. The wish of the gas engineer was probably father to this thought. The drawback to its realization is the hitherto irrecoverable loss of the proportion of the heat value of the coal which becomes sensible during the process of gasification—amounting to at least 30 per cent. Mr. Foulis claims for Mr. Beilby the method of steaming ammonia out of coke, which is the essence of Dr. Mond's fuel-gas process. With regard to the commercial prospects of the South Staffordshire Mond gas scheme, Mr. Foulis is reticent. He contents himself with the remark that the development of the scheme "will be watched with much interest," which is a very safe statement. The subject of the quantity of motive energy wasted in the squandered gases of blast-furnaces and coke-ovens afforded Mr. Foulis, as it has given others, the opportunity for putting together some picturesque statistics. These figures create the impression that motive power in itself, apart from conditions of time and space, cannot be worth much, if anything at all.

Mr. Foulis "gets home" very effectively with a proof that if the people within the district served by the Glasgow Corporation gas undertaking, with an area of some 120 square miles, want motive power, they can have it for asking, at the price of 0·39d. per horse-power-hour—say £4 8s. for a horse power per working year of 50 weeks of 54 hours. And it is to be remembered that there are no stand-by losses, no cost of removing ashes, no fireman's wages to pay, and the power can be subdivided for convenient application to the work without additional cost. This makes distributed electric power look an expensive luxury; and they do not go in for luxuries in Glasgow workshops. Regarded on the physical basis, moreover, Mr. Foulis's gas-engines, which already aggregate 9000-horse power, and increase rapidly in number and size, make a fair showing. It used to be the correct fashion for electricians and others to crow over the "unscientific" maker of gas, and affect to look upon him as a barbarian. Well, with an average gas consumption of 15 cubic feet per brake horse power, which cannot be called an exaggerated estimate, this means that the gas-engine situated at any point of a region 15 miles by 8 miles, takes per actual horse power the gas of 3½ lbs. of coal carbonized at the Corporation works. Not a bad rate of fuel consumption, as heat engines go. But there is something left over, in this case. There remains for sale coke to nearly one-half the weight of the original coal, besides tar and ammonia. Physically, therefore, the steam-engine is not to be compared with the gas-engine; and steam-generated electricity is, of course, several stages farther removed from this efficiency. It is not at all difficult to understand, after this exposure of the facts, why electric motors on town circuits do not come more into favour in the United Kingdom.

Mr. W. R. Herring on the Inclined-Retort Controversy.

IT is only necessary for it to be announced here that Mr. W. R. Herring has favoured the "JOURNAL" with an article on inclined retorts, in order to attract most gas engineering readers of these lines to the communication referred to, before everything else in the present issue. The advantages and drawbacks of the system of carbonizing plant in question appear to be as debateable now as at the distant period when it first challenged the attention of the technical world, which, as Mr. Herring has done his very best to settle the opinions of his professional brethren respecting the balance of the merit of the system, seems to be almost a reflection upon his powers of exposition. But everybody interested in the subject must agree with Mr. Herring that the problem which eludes solution in this disappointing way has been the most important of all the technical questions that have arisen in the gas industry during the past ten years or so. Volumes of technicalities have been written about it; and still "the how, the when, and the where" of the absolute test of its relative merit is not yet in any man's grasp. Mr. Herring has distinguished the "Editorial Notes" of the "JOURNAL" as responsible for putting what may be regarded as the preliminary question, of whether the inclined retort system is a successful rival of the horizontal retort system with modern mechanical stoking. He begins by reserving this question for later consideration, the while he addresses himself to the critics of his own household, of "sloper" partisans; beginning with Mr. S. Y. Shoubridge. There is a direct conflict of opinion between these masters of the technic of inclined retorts; and we are naturally disposed to stand aside and let such redoubtable champions fight it out. They may without offence, however, be asked not to forget in their ardour the old moral of the fight about the shield with differently coloured sides.

One small point should be cleared up. Mr. Herring gently twits Mr. Shoubridge with honouring himself by adopting his favourite section of the "flaring"-sided ⌂ retort. But does he really claim this pattern as his own? We seem to remember it as being of German origin. Mr. Herring is undoubtedly right in accusing English gas engineers of reluctance to spend capital on labour-saving mechanical devices, though the substitution could be shown to be economical. The word "complicated," and the unspoken judgment "untrustworthy," have come far too naturally to many British gas managers for the credit of the class. Consequently, native mechanical enterprise has been checked and

discouraged, simply because early attempts have not proved invariably successful straight away. With regard to Mr. Herring's quarrel with ourselves for not ruling horizontal retorts with mechanical stoking out of the running with his realization of the inclined retort system, we can fairly refer to the whole tale of "JOURNAL" comments on the rivalry between the two systems as evidence that, if the partisans of either could complain of partiality, it would be the horizontal retort men. We have again and again commended the inclined retort system, especially on the ground now taken by Mr. Herring—that it is as good in a single setting as in a thousand. But this was not the question raised by Mr. Herring's Congress paper. The point there was as to the carbonizing of 1000 tons of coal per day in one spot; and we should have laid the "JOURNAL" open to a charge of partiality out of all reason or excuse, if, knowing the contemporary practice of (say) Mr. Foulis in Glasgow and of Mr. Tysoe at East Greenwich, we had assumed that it is indefensible. It may or may not suit these Engineers to enter the lists with Mr. Herring; but, in all the circumstances, if they should decline to take up that gentleman's challenge, nobody will be in a hurry to claim that judgment must be given against them in default.

Labour Troubles in the Coalfields.

To readers of the "JOURNAL," recent developments in the South Wales coalfields, leading to a very grave situation, will not, we think, have come with surprise. The absence of serious strife in that district—local strikes and disputes not being counted—during the past two years has not been due in the least to a real peace, or to any friendly relations between masters and men, but entirely to the fact that trade has been exceptionally brisk. The men have been, in the main, kept quiet by high wages; and where difficulties have arisen, the masters have generally preferred to grant concessions rather than risk a stoppage. But signs have not been wanting to show the careful observer that not very far beneath the surface a fire of discontent was burning that would need but small opportunity to break forth and cause a serious conflagration. It has always appeared certain that this would happen when the inevitable reaction after the period of abnormally high prices made itself evident in the miners' rates of wages, especially in view of two facts—one, the inclusion of the South Wales coalfields within the "jurisdiction" of the Miners' Federation of Great Britain, subsequent to the troubles of 1898; the other, the approaching expiration of the sliding-scale agreement, to the principle of which the Federation has been strongly opposed. Sooner or later, then, some disturbance of the peace appeared to be almost inevitable.

The events of the past week would seem to point to that disturbance occurring soon rather than late. On Wednesday week, it will be remembered, the miners' representatives upon the Sliding-Scale Committee took the coal trade by surprise with an order to the men employed at the collieries in South Wales and Monmouthshire to "play" on the following Friday and Saturday—the object sought to be thereby attained being the stiffening of a drooping market in order to prevent a fall in prices and wages. This order was everywhere obeyed; but the effect on the market failing to satisfy the men's leaders, another stoppage was ordered for Thursday last. These "play" days are, of course, distinctly illegal; being breaches of the men's contracts with their employers. There being manifest difficulties in the way of prosecuting, and enforcing the payment of fines by, some 130,000 men, the employers on a former occasion preferred to pass over such a breach of the law, and would perhaps have again done so had the two days' stoppage first ordered ended the matter. But the declaration of another day's "play" last week, and the obvious intention of the men to adopt a definite policy of attempting to govern the market themselves, aroused the coalowners to the seriousness of the situation.

It being evident that, if they were to retain any real control over their own business, a stop must be put to the arbitrary interference of the men with the working of the collieries, the owners met on Wednesday last and decided to empower a Committee, consisting of their representatives upon the Sliding-Scale Committee, to take such action as they may be advised against the individual workmen guilty of breach of contract, or some of them; against the men who signed the notices calling the men out; and, further, against the South Wales Miners' Federation and the Miners' Federation of Great Britain. The third item in the bill is the one around which interest chiefly centres. The Federations, it may here be remarked, took no action, openly or officially, in regard to the ordering of the "play" days. These were stated to have been decided upon by the miners' representatives on the Sliding-Scale Committee, by whom, in fact, the notices to the men were signed. Those representatives being, however, members of the South Wales Federation—one is the Vice-President—and the vast majority of the men obeying those orders being also members, the owners have decided to proceed against the Federations, both local and parent, upon the advice, it has been stated, of Mr. B. F. Williams, K.C., who, it will be remembered, was one of the leading Counsel for the Taff Vale Railway Company in their action against the Amalgamated Railway Servants.

As to what will be the result of the proposed actions, it would, of course, be improper for us to express an opinion; it can only be said that the result will be awaited with very great interest. There is, however, one possible outcome of the decision of the owners to take proceedings—and of the subsequent determination, arrived at on Saturday last, by the men's representatives to order a fourth "play" day for to-morrow (Wednesday), that may be discussed. That is, the possibility of the owners declaring that their contracts with the men are, by the men's own action, determined, and forthwith locking out the whole of the miners rather than allow their business to remain subject to the capricious control of a Committee of workmen who claim to understand and to "safeguard" the interests of the owners better than these are capable of doing for themselves.

The more the action of the men is considered, the more astounding does their presumption appear; while their incapacity to understand the markets they desire to control becomes obvious. Mr. Brace, the Vice-President of the South Wales Federation, speaking at Abertillery last week, coolly stated that "it was no use leaving this question of "regulating the markets to the employers," who, one is left to infer, care so little about what profits they make that, even if they could prevent the price of coal falling, they would not take the trouble. Indeed, Mr. Brace actually stated that "prices had been brought down without con-"sideration as to whether the state of trade would warrant "the reduction or not;" and this he attributes to the action of the middlemen. What silly nonsense it all is! As if the middlemen do not get every penny per ton out of the buyers that "the state of trade" enables them to get. The middlemen are not arrant fools, but very shrewd business men; and they do not sell "futures" at a lower price than the prospect of trade—in short, the demand—will warrant. The men appear to imagine that the question of price depends wholly upon supply—that they have only to keep that down low enough for prices and wages to go up. So they would, for a time, perhaps, and might go up almost high enough to compensate for the loss of volume of trade and work (if a miner is only going to raise 250 tons instead of 350 tons a year, he will want a 40 per cent. increase in his rate of wage to give him the same earnings) if there were no other coal in the world to sell, and all users were compelled to consume the same quantity, whatever the price. But with a falling market everywhere, the curtailing of the output in Wales, and advertising the slackness of business there, are likely not only to benefit other sellers than either the Welsh miners or their masters, but to "bear" that market more than ever.

Nothing could better demonstrate the ignorance of the men as to their true interests than the fact that last year, when the demand for coal was phenomenal, they played the same game of checking output, though to a less obvious degree; the South Wales coalfield being the one district in which the output was less than in 1899. The condition of the market during 1900 was such that a full output from Wales would have commanded practically as high an average price as did the restricted supply, so that the total profit to the owners and the earnings of the men might have been much higher if the latter had not played the fool. Yet they take credit for understanding the coal market better than those whose fortune is staked upon it.

The outlook in Wales is, then, distinctly gloomy; and elsewhere in the coal world labour troubles are not wanting. About 3000 men are idle at Rotherham over a timbering dispute; in Derbyshire and in Wales, the Unionists are playing the familiar game of threatening to strike against the employment of non-Unionists; in Scotland, the men are asking an advance in wages which the masters are certain to refuse; while in Northumberland, the incidence of the coal-tax may cause some trouble. All these difficulties have

behind them, also, the dislike of the men for a falling rate of wage. Coal buyers must hope for the best, while not ignoring the possibility of serious disturbance.

The Work of the Gas Companies' Protection Association.

THE Annual General Meeting of the Gas Companies' Protection Association was held on Thursday, under the presidency of Mr. George Livesey. The account of the year's work of the Association as given by the Secretary (Mr. F. E. Cooper) is ample justification of the existence of the organization, and proves that at the present time Gas Companies more than ever need to band themselves together for mutual defence against the numerous antagonistic interests, new and old, which beset them on every side. The question of electrolytic damage to gas-pipes from stray electric traction currents is one of the principal matters that occupied the attention of the Committee of the Association during the past year. A deputation to the President of the Board of Trade was arranged; but as, at the request of the Minister, the proceedings were treated as of a private and confidential nature, nothing transpired concerning them. The names of the gentlemen forming the deputation, however, are a sufficient guarantee that the cause of the gas industry was safe in their hands.

The actual burden of fighting the question of the electrolysis of gas and water pipes, in the Parliamentary Committee-rooms, was undertaken by the London Gas Companies, at a cost of close upon £3000, which shows how seriously the Companies concerned regard the matter. Mr. Livesey well explained the position in his address to the meeting. The truth is that the subject is of the nature of real tragedy—a conflict of rights, both worthy of respect in their way. There is no monopoly of right on either side. The Gas Companies simply want peaceable and safe enjoyment of their statutory rights to the use of the subsoil of streets; and the electric tramways and railways want to be permitted to do their own business in the cheapest way. The public are really the party concerned on both sides, which is just as well, as they have to pay for getting the problem solved. One request made by Mr. Livesey in this connection needs to be emphasized. The possibility of obtaining better protection from the Board of Trade for gas and water mains is a question of evidence. There is no proof as yet of any damage having been done to gas-pipes by electrolysis where the Board of Trade regulations are in force. There was one case, from Liverpool, spoken to by Mr. William King, on a Water Company's petition; but it was not sufficient. Consequently, Mr. Livesey asks that wherever a clear case of electrolysis under the stated conditions comes within the knowledge of a gas manager in the United Kingdom, he should not cut the pipe out and send it to anybody, but immediately report the fact to the Secretary of the Association, in order that an investigation may be made on the spot by a competent person. The reason for this is that electrolysis may occur through the galvanic action of some constituents of the soil, as well as from stray traction currents. Besides, if the latter are the culprits, it is desirable to catch them at it.

The arsenical coke scare also gave the Association some anxiety; but the matter eventually worked itself out in the manner described by Mr. Livesey, without the Gas Companies finding it necessary to do anything. It is not, however, such glaring subjects as this which demonstrate the usefulness of the Association, acting as it does through an experienced Parliamentary Agent, but such insidious dangers as the threatened alteration, at the instance of Progressive Municipalism, of the Borough Funds Act. Another obscure cause of action on the part of the Association was the Steam-Engines (Persons in Charge) Bill. This is a parliamentary annual, promoted in the avowed interest of Socialistic Trades Unionism, and is more than usually mischievous. It was happily defeated, with a strong expression by the Committee as to its being absolutely unnecessary. Yet it remains as a standing warning of the class of vexatious attacks to which established industries are continually exposed. The treatment of income-tax problems is also one of the important cares of the Association. Of course, Mr. Livesey knows all that is worth knowing on this head; and his observations on various difficult points of Somerset House practice are well worth having.

It is a pity that the Association are not better supported by British Gas Companies. Perhaps after what was said on this point at the meeting by the Chairman, Mr. Berridge (of Leamington), and others, this reproach will be removed. The truth of the matter is, as the Chairman stated, that the advantages of co-operation rest chiefly with the smaller Companies and those doing business in remote localities. The big Companies can look after themselves. Gas Companies should take example by the Railway Companies, who find union most beneficial, although the great lines have their own parliamentary offices in Westminster. It is a considerable comfort to country Gas Companies to know that, in cases of difficulty new to their experience arising in their locality, they can apply as of right to an experienced adviser for counsel.

Supplying Gas-Meters as Stand-Bys.

A PARAGRAPH appears in an electrical contemporary which arouses some poignant reflections. It is stated that electricity supply undertakings, whether owned by companies or local authorities, are feeling the burden of the consumer who has his own generating plant and only relies upon the public mains when his own machinery breaks down. Certain corporations are stated to be taking measures to deal with these troublesome customers. In the forthcoming session of Parliament, Bills are to be promoted containing, among other proposals, clauses to relieve the municipal suppliers of electricity from the compulsion to supply "except on terms affording the corporation a reasonable return on the capital expenditure involved." This goes to the root of things. What is meant, probably, is merely the conferring of a power upon the corporation of making a minimum charge. This is precisely where many a gas company are badly hit by public electricity supplies. The consumer no longer uses his meter—perhaps a large and expensive one—while he can get his electric light; but he keeps it, sometimes without paying any rent, as a stand-by. Such a practice is not only unfair to the gas company, but is distinctly opposed to the spirit of the Electric Lighting Act, 1887. This Act provides, by clause 29, that where in any area, "or any part thereof," a statutory gas supply has become unremunerative to the undertakers by reason of the sufficiency of the authorized electric light service, the Board of Trade may, on the application of the gas undertakers, relieve them of the obligation to supply. If a Gas Company can be relieved of the obligation to supply gas, they can certainly claim the minor relief of not being compelled to keep a meter on the premises for nothing. There might be a question whether a single house is any part of an "area," within the meaning of the Act. On that point we cannot presume to express an opinion. Inasmuch, however, as an "area" for the purposes of the Act is only an aggregation of possible consumers' houses, it might be thought that what applies to the whole would apply to one of the economic parts. The question is a curious one; and now that local authorities feel the pinch of the shoe, and are not too proud to ask for relief, possibly some gas companies may confess the same grievance.

The Canker of False Corporation Book-Keeping.

THE attention of directors and managers of gas companies doing business in towns where the municipality supply electric lighting, should be directed to certain features of the latter business, as ordinarily conducted, which are usually concealed, to the detriment of the ratepayers' estate generally and of the gas industry in particular. The Auditor of the accounts of the Croydon Corporation has exposed the practice of this Local Authority in neglecting to provide for the depreciation of their electrical plant, and in not charging against the department the cost of the clerical and other work done at the Town Hall. Both these omissions are common practice. It is stated that Belfast, Bolton, Bradford, Hanley, Lancaster, Manchester, Oldham, Portsmouth, and many other places, charge to electricity nothing whatever for office accommodation, the services of the Town Clerk, and similar very real administrative expenses, which companies have to pay. As regards shirking of depreciation, which is equally general, the usual stereotyped excuse that the sinking fund is an equivalent of such a charge, is met by the Croydon Auditor with the contention that this cannot be, because the percentage that must be set apart for redemption is less than one-half the proportion that ought to be put by for depreciation. The first result of this improper proceeding is that the price of a municipal supply of electricity is made for the time being to compare unduly favourably with that of a company supply. From this, of course, the generalization in favour of the municipalization of everything is easy. If a corporation can conduct so new and delicate a trade as

electricity supply at an average cost to the consumer of 1d. per unit lower than the charge of a company, who can say that they are not to be trusted with simpler enterprises? This is the argument. It is quite familiar.

The answer is that it is not true. If electric lighting companies charge more for their current than municipalities do, the truth is that the former know their business, and the latter do not. Moreover, a company have no town hall to house them, and no rate-fund to fall back upon. Besides, it will be noticed that, up and down the country, local authorities have had to raise their prices for electricity as quietly as possible; while companies have not, as a rule, done this. The excuse of the corporations is, of course, the higher cost of coal, which has been to them a real godsend. But their trouble is not to be covered up for long in this way. They have one and all scouted the suggestion to "depreciate;" but, strangely enough, they all find it necessary to spend more and more money on repairing their plant. This expedient, also, is only of limited duration. Local authorities may patch and patch, and keep off the scrap heap worn-out stuff which should have been turned out of service years ago; but the time will come when renewals must be made, and what will be done then? Ask those who will be in a position to trace the application of all the money that will be borrowed for "extensions." It is bound to come to this. The Dublin Corporation were the first to hit on the happy excuse that a sinking fund is a depreciation allowance; and their first electric lighting plant has only been saved from being the earliest exposure of the fallacy of this pretence by becoming absorbed in a bigger venture. This is a game that cannot be played twice in the same place. It behoves the directors of gas companies, as large ratepayers, to see that, where this kind of municipal trading is carried on, the truth concerning it is known. If the ratepayers approve of it with their eyes open, that is their affair; but municipal trade ought not to be carried on under false pretences.

The Burden of Germany.

HUMAN nature being what it is, most people have felt more or less sympathy with those volatile Athenians who lynched a public man for sheer weariness of hearing him perpetually called "the Just." Similarly, if there is one man whom the average British technician hates with a bitter hatred, it is the triumphant and scientific German manufacturer heard of on platforms and read of in newspapers, who is carrying all before him by his science and enterprise. Consequently, the British manufacturer would not be human if he did not chuckle over the contrast now being exhibited between the platform representation of his German rival, and the truth as the German Government know it. One day last week, Sir Albert K. Rollit, M.P., speaking at Blackpool, said that it is in chemistry and the allied sciences that England has to make up a good deal of leeway. This is true enough, so far as it goes; but when the speaker went on to mention in the same breath that there are 15,000 students of science at the German Universities, and that Germany was credited with an export trade during the last quarter-of-a-century of 50 millions sterling in scientific products—as though the two were cause and effect—he was talking somewhat wildly. German Universities always have been popular; but not very much has often come of the circumstance.

More to the point is the report that the German National and City Governments have had to concert measures for dealing with the lack of employment for the working classes. The City of Dantzig proclaims its willingness to find employment for one hundred men "as agricultural labourers." This does not look very much like manufacturing prosperity. "The railway administration has, moreover, intimated its "readiness provisionally to grant free tickets under the "control of the Municipality to workmen so employed. "The cost of these tickets will eventually be charged to the "employers." The last sentence is worth studying. This is what a paternal Government has to do. It is the same in Austria, where the various Ministerial Departments have placed large orders with local manufacturers—not because they want the goods, but so as to keep the workpeople off the streets. The truth of the situation is that the forced nature of the Continental industrial competition with the United Kingdom, of which so much has been heard of late years, is betraying itself, as it was bound to do sooner or later; and not all the Universities of Germany will check the trouble until trade and commerce have returned to their normal channels. In Protectionist countries, however, the difficulty is to know what these channels are.

WATER AFFAIRS.

Rainfall and Village Water Supplies.

IN another part of the "JOURNAL" will be found abstracts of the remaining papers taken on the first day of the recent Conference on Water Supplies and River Pollution, with a report of the discussions upon them. They covered four very different subjects—three being of general, and the fourth mainly of local, interest. Without wishing to draw any invidious distinctions, we think the paper by Dr. H. R. Mill, dealing with the relation of rainfall and population to water supplies, is of conspicuous importance. To mention rainfall is to bring back to the memory one who laboured long and conscientiously to obtain systematic records in regard to it. We refer, of course, to the late Mr. G. J. Symons, whose life-work was the collection of rainfall statistics relating to the British Islands, the completeness and extent of which at the time of his death will be a lasting testimony to his indefatigable zeal. When it is added that Dr. Mill has taken up the work, it is unnecessary to claim for his utterances on the subject the most attentive consideration. Rain, as he aptly remarked, is the life-blood of every country; and, consequently, all the conditions determining its distribution over the land, and its subsequent fate, demand most careful study. The late Mr. Symons secured the co-operation of a number of willing assistants in all parts of the kingdom; and they are continuing their self-imposed labours. One result of this has been that Dr. Mill was able to present to the delegates at the Conference some valuable information. Happily, we are not deficient of the "life-blood" of which he spoke. The average rainfall in England and Wales is about 34 inches per annum; and an inch of rain a year falling upon an acre of ground is equal to 62 gallons a day. Moreover, he gave them the gratifying assurance that one-thirtieth of the total rainfall would be sufficient to supply 35 gallons per head to a population twice as large as the present. But he was careful to point out that averages are deceptive—never more so than in the case of water supply; and that therefore exceptionally dry years—possibly several in succession—have to be provided for. Consequently, while Dr. Mill thinks no anxiety need be felt as to the future supply of water, he reminds us that the increase in its legitimate employment is taxing the available sources in many places, and that the cost of keeping pace with the requirements may in certain localities become prohibitive. He therefore very properly enjoins economy in the use of water—not the economy which would curtail the quantity used for drinking, washing, and bathing, but that which would lead to the systematic checking of waste arising through defective fittings; and he considers this object might be effected by the education of the consumers. Furthermore, he would endeavour to utilize our generally abundant rainfall by collecting it from the roofs of buildings, and storing it in underground tanks.

Dr. Mill's suggestion bears to a certain extent upon the subject of village water supply, which was dealt with by Dr. Thresh and Miss Cochrane. The former complained that the Public Health (Water) Act of 1878 had signally failed, as in every rural district there are still to be found large numbers of cottages unprovided with a supply of water. He attributed this to the fact that difficulties had been placed in the way of sanitary authorities, whereas owners of property were afforded as many excuses as possible for delay, and were given as many causes as could be devised for appeals to the Local Government Board. The author pointed out in what respects the Act had, in his opinion, proved a dead-letter. Power was, he said, required to sink a well in a central position, and charge the cost upon all owners within a certain radius whose tenants had not a wholesome supply; and where a public supply could not be laid on to each house, wells or protected springs should be provided in central positions, and maintained at the expense of the parish. An example set by sanitary authorities to builders and property owners would, in his opinion, lead to the proper construction and protection of wells. Dr. Thresh called for a simplification of the law. Miss Cochrane directed attention to the deficient supply of water in villages, and complained that in certain districts the schools were without any water whatever. She appeared to favour the idea of either placing the supplies in the hands of the County Councils, and spreading the expenses over the whole county, or making the owners of property responsible. With reference to the schools, she thought the Education

Department should withhold their grant for any schools unprovided with wholesome water. The suggestion is worth following up; for it seems absurd to cram children's heads with what Pope called "learned lumber," in order to secure the grant, regardless of their physical well-being. Dr. Thresh offered some useful comments upon Miss Cochrane's paper, and laid stress upon the difficulty an engineer experiences in supplying a small village community as compared with a large town. He thought districts might be advantageously combined for furnishing an area with water. This could not be done, however, until the powers of County Councils have been enlarged. Possibly the proposal for catching and storing the rain water might afford relief, pending the carrying out of larger measures. At all events, the subject of the two papers calls for serious attention; for, as Dr. Mill pointed out, the health of the whole country depends more than is usually recognized upon the hygiene of villages, in which the early years of so many of the dwellers in towns are spent. We have had put before us, within the past few days, an elaborate scheme for "the possible improvement of "the human breed." Here is, we venture to think, a much more practical one: Improve all round the conditions of village life. The initiation of such a project would be a definite step in the direction of removing evils which are at present acknowledged to exist among rural populations. But so simple a remedy would in all probability be treated by the *doctrinaires* with the scornful contempt with which the command of the prophet of old was treated by the leper-captain of the host of the Syrian king.

Development of the Intercommunication Scheme.

When referring, a few weeks ago, to the critical condition of the water supply in some of the large towns in the North of England, owing to the prevalence of unusually dry weather, we ventured to express gratification at the fact that the Metropolis had passed through this trying period without having to submit to any inconvenience from a curtailment of the supply. During July the quantity of water delivered daily by the eight Water Companies averaged 38 gallons per head for all purposes; while in the following month it was about 36¼ gallons. We are not aware that any special notice was taken of the fact by the newspapers, on the principle, probably, that the Companies should find sufficient praise in the absence of censure. At the same time, the maintenance of an unfailing supply of water through two such months as those mentioned was a by no means easy task. But it must be acknowledged that it would have been very much harder, at all events in one portion of the Metropolis, had it not been for the facilities which now exist for mutual assistance being rendered by the Companies. The necessity for means of interchange of water, which had been recognized for some years by the Local Government Board, was brought prominently under their notice, as the Official Water Examiner records in their last annual report, in 1895 and 1896, and again in 1898 and the following year, when the East-end, owing to the prevalence of drought, suffered from an inadequate supply. The result was the initiation, at the suggestion of the Board, of a scheme of intercommunication, which subsequently, though not without some opposition in a certain quarter, received the sanction of the Legislature.

The first works undertaken were confined to the provision of means of passing the spare water from the mains of the Southwark and Vauxhall and Kent Companies into those of the East London Company, and for recouping the New River Company in part for the water they allowed to pass their intake on the Lea for the benefit of that Company. Subsequently, other auxiliary works were carried out; and then, at the instance of the Local Government Board, a general scheme of intercommunication was prepared by the associated Companies, which has been approved at Whitehall. Its formulation was not unattended with difficulties. This is not surprising, considering that eight Boards of Directors and eight Engineers had to be brought into agreement on many points, and the Local Government Board to be satisfied on engineering and financial matters. Then, in carrying out the work, there has necessarily been interference with the public highway, which has brought upon the Companies a great deal of odium, though in the matter of disturbing the streets and interfering with the traffic, they are by no means the greatest sinners. This was fully shown by the articles in last week's "Journal." No necessary public improvement can be effected without causing inconvenience to somebody; but it is in most cases amply compensated by the ultimate benefit derived from it by the entire community There cannot be a doubt that this will be the result in the case of the recent main-laying operations of the London Water Companies. The work was urgently called for, and was undertaken at the suggestion of a Government Department and this fact should, we think, in fairness, be borne in mind by those who include the Companies in the censure which is being freely bestowed on those who are responsible for the present condition of some London thoroughfares.

Manchester District Institution of Gas Engineers.—We learn from the Hon. Secretary (Mr. J. Wilkinson, of Sheffield) that the next quarterly meeting of the Institution will be held at Wakefield on Saturday, the 30th inst.

Mr. George Livesey and the Proposed Gas Exhibition at the Crystal Palace.—Mr. Livesey asks us to inform readers of the "Journal" that he has withdrawn his consent to open the proposed Gas Exhibition at the Crystal Palace next month. He desires this publicity, because inquiry is being made whether he is in any way a promoter of, or responsible for, the projected Exhibition. He is neither.

Societe Technique du Gaz Prizes.—Notification has just been sent to the members of the French Gas Society of the prizes that are open for competition for the session of 1901-1902. They are practically the same as were arranged for the previous session, details of which were given in the "Journal" at the time—see Vol. LXXVI., p. 1394. It would increase the interest in these competitions if some English gas engineers or manufacturers entered for these prizes, which are open to all comers of any nationality.

The "Honour" of British Municipalities.—This was the title of an editorial paragraph in the "Journal" for the 15th ult. An instance of what was described as the "besetting sin" of some Municipalities has since occurred at Bingley. At their meeting yesterday week, the Urban District Council adopted the Gas Committee's recommendation that no more lamps be erected in the Council's district supplied by the Clayton Gas Company; the Chairman explaining that by so doing they would not have so much to pay when the Council wished to purchase the mains, &c., in their district. There was a tacit understanding with the Bradford Corporation, he said, that when the latter acquired the Company's works, there should be a re-sale to Bingley of a portion of the undertaking.

Subways for London.—It appears, from what occurred at the meeting of the Highways Committee of the London County Council last Wednesday, that some steps will be taken to obtain parliamentary sanction to a scheme of subways for London. Of course, the proceedings of the Committee were conducted with closed doors; but an indication of their nature has been made known through the medium of certain newspapers. Consideration was given to the widespread public dissatisfaction existing at the continual and increasing interruptions to traffic caused by the breaking up of the roads; and the remedy was felt to be the construction of subways in all the main streets. The Committee further considered the desirability of making the subways large enough, where necessary, to carry a system of underground tramways; the whole work to be undertaken, under a recognized plan, by the Council as the central authority for London. The Committee will recommend that body to apply for the necessary powers. It is understood that, in the event of these being granted, a beginning would be made along the central line of route already suffering from congested traffic—probably following the line of Broad Street, Cheapside, Fleet Street, the Strand, Whitehall, and Victoria Street.

Responsibility for Breaking-Up London Streets.—In the editorial article on "The London County Council and the Opening of Streets" in the "Journal" last week, attention was called to the fact that the Victoria Embankment had never been entirely closed until it came under the control of the Council. Curiously enough, a letter referring to the same matter appeared in "The Times" last Friday. After alluding to the intention of the Council, as shown at their meeting on the 22nd ult., to seek for greater powers over the streets, the writer expressed the hope that, before granting them, Parliament would take notice of their proceedings in regard to the embankment roadway, parts of which had been absolutely closed for a fortnight or three weeks, so that all the traffic generally passing that way had been thrown upon the already crowded Strand and Fleet Street. He laid stress, as we did, upon the fact that this was not a partial closing, such as would be required for pipe-laying, but a "complete closure." As one well versed in road-making, he declared without hesitation that this was unnecessary, as half the road could quite as well be laid at one time as the whole of it, if proper means were adopted. Of course, it is not surprising to find that the example set by the Council has been followed by some of the minor Local Authorities, who have now no hesitation in stopping entire streets, and thereby causing the greatest possible inconvenience. As a resident in London for upwards of fifty years, the writer of the letter says he does not recollect any such interference with traffic prior to the action of the Council.

ESSAYS AND REVIEWS.

A DEMOLISHED GAS PAVILION.

THE Gas Pavilion of the Paris Exhibition of 1900 is no more; but it was by no means a bad idea to perpetuate its memory in print and paper, as has now been done by a volume of over 100 pages, recently published by the Commission d'Exécution de l'Exposition Collective de l'Industrie du Gaz en 1900. It may be that neither in size nor situation, nor yet in its contents, was the Pavilion altogether worthy of its subject; but, none the less, it would have been a pity had it been relegated to the region of the past without any record of it being put into a permanent form. At the time of its construction and completion, it was illustrated and described in the columns of the "JOURNAL,"* and, therefore, the merely introductory and descriptive remarks of the volume under review do not call for comment.

It may be noticed, however, that exhibitions, or their sections, are not built up in a day—as the preliminary proceedings in connection with the establishment of the Gas Pavilion in question dated from the year 1896. It is called to mind how, in 1889, the new-born electrical industry pretended to have banished gas from domestic and commercial uses, and how the older illuminant had then displayed the power, extent, and variety of its resources, and had shown the public its ability to satisfy its every want, which the younger rival flattered itself was to be its sole prerogative. Since that time, in spite of every assistance, both moral and financial—and, one may add, municipal—that has been accorded to electrical endeavour, gas companies have been able to show, slowly, perhaps, but surely, and with far less noise and commotion, that their commodity is still to-day the supply, *par excellence*, of energy in its principal forms of lighting, heating, and power.

Under the heading of "Gas-Works Material," brief mention is made of the part played by regenerative furnaces, inclined retorts, stoking machinery, and other plant. The classification of five different kinds of coal is given; being the result of over ten years' work by M. Ste. Claire-Deville, the Chemist of the Paris Gas Company's experimental works—works such as have been advocated more than once by many English engineers. A chapter is devoted to the consideration of the gas-engines exhibited, and to gas-engines generally. In this connection, the addition, made in the year 1801 by Philippe Lebon to his famous patent of two years previously, is quoted:

> In a cylinder A is effected the combustion of inflammable gas, which is introduced by a pipe B, the atmospheric air required for the combustion being delivered thereto by a pipe C. The cylinder receives the vapours produced by this combustion. Its piston cuts off all connection between the front and back parts. . . . Outside of the cylinder the piston-rod is divided into three further rods. One of them works the piston of a double-acting atmospheric air-pump; another one works the piston of a similar inflammable gas-pump; and the third is intended to be applied to the resistance which it is proposed to overcome. . . . As regards ignition, an electrical machine can be arranged so as to repeat the explosions at regulated and calculated intervals of time.

Philippe Lebon's untimely death did not, unfortunately, allow of his completing and formulating his ideas in a practical way; otherwise the subsequent history of gas-engines to that of Lenoir, in 1860, might have been very different.

The industrial uses of gas are then reviewed, and many and varied are the forms illustrated and described—from the welding of a carriage wheel to the ironing of a shirt. Its domestic applications are suitably divided into three parts: Gas for warming purposes; for bathing purposes; and for cooking purposes. Under each of these headings interesting examples are shown, together with many facts of practical value. The following chapter is devoted to "Lighting;" and incandescent burners, holophane globes, and some artistic lamps and chandeliers are mentioned, and photographic reproductions given. In a brief but attractively written "Historical Section," engravings appear of the large statue of Lebon, which was placed in the Pavilion (and of which reduced copies in bronze may be obtained), and of the gas-works established in Paris, in the year 1820, for the St. Louis Hospital. These primitive works existed until 1860; and it almost seems a pity that it was not possible to keep them intact, as an example of gas engineering in early days. As the invention of gas lighting belongs to those conquests of science which have changed the whole surface of the world, it is not surprising that England with Murdoch, France with Philippe Lebon, and the Low Country with Minckelers, all claim the honour of its introduction. The evidence in support of the last two claimants was fully and duly deposited in the Gas Pavilion, and documentary substantiation was forthcoming. But where was the case for Murdoch? "The English did not reply to the inquiry which was addressed to them by the Sub-Committee for the History of the Gas Industry. Is their silence to be attributed to the reserve which they showed with regard to the Exposition Universelle of 1900, or to the insufficiency of the grounds of conviction? However that may be, the claims of Murdoch were not even presented." Whoever, or whatever, may have been responsible for the passing-over of an undoubted opportunity for filing in an International Court, so to speak, the proper papers for the pretensions of Murdoch, certain is it that the occasion has been turned to account by our Continental brethren. May we not see, in this little instance, another example of our self-satisfied insularity and self-complacent pride, and turn the lesson to some small profit in the future?

This record of the Gas Pavilion closes with an account of the meetings held in it, which were supplementary to last year's International Congress, and reference to which was briefly made at the time.* M. Euchène's further tests on the heat required for the distillation of coal, M. Hovine's remarks on inclined retorts, and M. Godinet's notes on the utilization of natural forces, are all now collected and published. The volume as a whole, which is well printed and illustrated, will serve, in time to come, as a useful reminder of a bye-gone Exhibition.

* See Vol. LXXV., pp. 140 and 1356.

ARRESTED DEVELOPMENT OF MANUFACTURED POWER GAS.

THE endeavours of persons of an inventive turn to improve upon the details of the well-known processes for producing fuel gas, do not exhibit any symptoms of flagging. This is a matter which naturally interests gas engineers keenly; if only because every one of these inventors makes no secret of his desire to supersede ordinary gas as a cheap source of power, and usually claims to have succeeded in doing so. It is therefore, just at the present time, worth making the point that, as a matter of fact, these fuel and power gas processes are not progressing. It is a long time since a real novelty in the way of so-called "producer gas" made its entry upon the technical scene. It is quite immaterial for the moment whether Dr. Mond or Mr. Emerson Dowson was the latest comer into this field; both are of long standing in the fuel-gas business, and they have had no supplanters. The number of professedly proprietary fuel gases is considerable; but they do not differ much in the essential character of calorific value. Slight differences of process there are, no doubt; but the ultimate result is pretty much the same with all.

It is this sameness of value in the gaseous product which ties down the fuel-gas business to a well-understood limit of utility. Nobody can improve upon it. No continuous-acting gas-producer will make gas of more than 150 British thermal units to the cubic foot; and no responsible maker of such plant would accept a contract binding him to work to this figure as a minimum. This is one of the cardinal points of the situation. And there are others of equal importance. One of these has to do with the character and cost of the raw material of the manufacture; the other with the question of power for space. There are many gas-power installations in different parts of the country where the original producers are rusting in idleness, while the engines are either being driven by ordinary gas, or have been superseded by steam-engines. Power-gas producers must use anthracite, coke, or common bituminous coal. If they are not to give trouble, are to work at their best gait, and furnish the utmost satisfaction of which they are capable, the fuel must be the cleanest, brightest anthracite that South Wales can yield. Dowson plant, with this class of fuel, is still unsurpassed; although it has been in the market for twenty years and more. But, of course, the coal is high-priced, and not always and everywhere easy to obtain when wanted. If it has to be procured in advance and stored by the truck-load, that means occupying more space.

The use of gas coke in a power-gas plant means the provision of more purifying apparatus than is needful with anthracite; and the power of the producer is less, while the attendance upon the fire must be more frequent and intelligent. Again, no inventor has improved upon this order of things. When one descends upon common coal for gasifying, this entails the provision of a regular gas purifying plant, as in an ordinary coal gas-works; which puts the suggestion out of court for most cases. No invention gets over this! Even if there is no other objection, the amount of space required is usually fatal to the system. Of course, where this bulkiness is no drawback, or where water is scarce or bad, a poor bituminous coal gas-power plant may, and does, possess commanding advantages. We have had occasion to concede this in respect to the work being done in the Mediterranean countries by Messrs. Pierson, of Paris, and other fuel-gas engineers, with a class of coal which is not of much use for anything else. In the United Kingdom, however, the case is different. There is no use denying that for compactness and convenience in working, a Willans and Robinson, or a Belliss steam-engine can give points to any gas-power plant making its supply on the spot.

Greater intensity, more work per unit of ground space occupied, should be (but is not) the aim of power-gas manufacturers. Until some substantial advance has been effected in this respect, the established gas industry need not fear the competition of any gas-producer system; and the steam engineers will continue to sell their engines. It is all very well for Sir Frederick Bramwell and his like to talk at large about the superior economy of fuel-gas engines as compared with steam-engines; but practical power users know that this consideration—even when it is true—is not everything, and it is doing an unkindness to would-be inventors of fuel-gas processes to pretend that it is. So many of these

* See "JOURNAL," Vol. LXXVI., p. 637.

painstaking persons appear to think that success with a gas-producer is only a question of making gas. They do not know that this is not the problem. On the contrary, making the fuel gas is the easiest operation to perform in accordance with conditions accepted by the gas manufacturer himself. Give him his anthracite and his elbow-room, and he will make gas quite successfully. It is only when the conditions are set by somebody else that trouble arises. Our present point is that no progress whatever is being made in rendering power gas better able to overcome these adverse conditions, which have already extinguished the fires of so many producers. No better or stronger gas is being made; the yield of gas per unit-area of fire-grate is not being increased. If these positions can be attacked, we shall be delighted to afford facilities for the onslaught.

Our attention has lately been directed to a gas-producer bearing the name of the "Dynamic" producer. From all that is said about it, the chief virtue on which this apparatus is intended to court favour consists in its being destitute of a gasholder. There is a producer with a kind of boiler on the top, which supplies a steam-jet to the fire; and that is all. The engine is supposed to draw in its gas as it wants it. Where the superior efficiency of this artless device (which resembles a very early Dowson plant) comes from, there is no attempt to show.

So long as traders in power-gas producers continue unable to make any advance upon established practice, the popularity of the gas-engine will chiefly attach to those supplied by coal gas at a reasonable figure. We say this without forgetting the advantages of gas power, up to 300-horse power or thereabouts, for isolated factories where room is available for the producer and gasholder. In such cases, the convenience of being able to subdivide the driving power into units of from 15 to 30 horse power would alone be sufficient to recommend gas made on the premises. Cheap as the power is in this case, its cheapness is not its sole recommendation. These instances, however, are less numerous than those in which the ordinary coal gas passes the works gate, and can be had upon reasonable terms. We would fain believe that town's gas for power purposes is to be had without exception at reasonable prices; but this would be taking too favourable a view of the commercial prospects of the gas industry. It is often the Gas Company, or Corporation Gas Committee, who by their uncommercial notions drive manufacturers and factory-owners back upon producer gas or steam power.

While the cause of power gas is at a standstill by reason of the inability of the designers of producers to improve upon the standard patterns of plant, it is threatened with eclipse by the growing efficiency of the oil-engine. This is a form of competition which, for obvious reasons, will play more havoc with the power-gas trade than with either steam or coal gas engines. Not to discuss over again the peculiar recommendations of steam power—which are not likely to be overlooked or undervalued—it is clear that a gas-engine which is supplied from the street-mains does not occasion the user much anxiety on the subject of the supply of the working fluid. Although he may grumble at the price, the user of the engine can as a rule depend upon its regular and uniform supply of gas. This is certainly not the case with home-made power gas, unless the installation is of considerable size. Besides, although in an engineering works there is always on hand enough technical aptitude to keep the plant going right, this is not the case, say, at a flour mill, or a country printing works. In view of these occasional difficulties, the proprietary may well be advised to bestow a thought upon the oil-engine, which is now a quite reliable motor. If it is a case of generating the working fluid on the spot, why not oil gas as well as, or perhaps better than, producer gas? It is a very pertinent question. We have lately heard of an improved device for supplying oil-engines with the necessary oil vapour, which appears to depend upon a simple pre-heating arrangement for the oil. There is plenty of room for the improvement of this part of oil-engine equipment; and the contemporary enterprise of road-motor carriage building is very actively occupied with carburettors, vaporizers, and the like. All this encourages the belief that the oil-engine for stationary work is a promising motor. As to the cheapness and general availability of petroleum, nothing need be said. These considerations, therefore, do not presage a brilliant future for the small or medium-sized power-gas engine, with its producer, which does not improve. If one could distinguish any possibility of the considerable improvement of the power-gas producer, it would be something to discuss; but there is no such prospect. The mischief does not really rest with the inventors who do nothing in this direction, but with the nature of things. They cannot work miracles; and nothing short of a miracle would seem to be called for in the circumstances, to make producer gas worth much more than it is, or to make it do much more than it has done. As already remarked, we shall be very glad to hear from anybody who will argue that this judgment is mistaken.

The fiftieth scientific anniversary of M. Berthelot, who began his career as a chemist in 1851, is to be commemorated by the presentation to him of a metal plaquette by his colleagues of the Institute of France. On the front of the plate, the recipient's portrait will be reproduced in profile; and on the back M. Berthelot will be portrayed seated at his laboratory table—Truth illuminating him with a torch, and Patrie protecting him under a flag, and offering him a crown of laurels.

PROCEEDINGS UNDER THE CONCILIATION ACT.

THE Labour Department of the Board of Trade have published their third report, covering the two years ended June last, upon the proceedings of the Department under the Conciliation (Trade Disputes) Act, 1896. The Blue-Book runs to a matter of 130 pages; but we cannot say that the achievements chronicled therein are commensurate with the space they are made to occupy. The results of the intervention of the Board of Trade in labour disputes have not been such as to warrant anyone in contending that the Act of 1896 has in any perceptible measure lessened the number of strikes, or assuaged the bitterness of such disputes. Where the arbitrator or "conciliator" appointed by the Board has brought about a settlement, the probabilities are that, even had no such statute been in existence, an arbitrator would have been chosen and a settlement effected; both parties in such cases being often merely anxious to find a convenient way of "saving their faces" by agreeing to a compromise proposed by a third party.

In the case of really serious trouble between employer and employed, it cannot be said that the Board of Trade have been able to do much—nor is that matter of surprise. There are some questions which no employer with any self-respect would dream of submitting to arbitration—to do so would be to relinquish for ever any claim to be master of his own workshop; and some of the most determined struggles in the industrial world have taken place really over such fundamentals, though perhaps ostensibly over questions of pay or hours. In such cases, it is no good for officials of the Board of Trade, or Lord Mayors, or other well-meaning people, to proffer their services—any more than it would be for a foreign nation to offer to intervene between this country and the Boer rump. There are some differences that cannot be settled by arbitration.

So we see, in looking through the detailed statement of cases in which action by the Board of Trade under the 1896 Act took place, or was invited, during the past two years. For example. In July, 1899, a strike of file-makers began at Warrington. At the end of the following September, the Secretary of the Union requested the Board of Trade to take action in the matter. "An officer of the Department visited Warrington, and had interviews with representatives of both parties. As it appeared that the firms involved were not willing to offer any advance on existing rates, or to submit any of the matters in dispute to arbitration, the applicants were informed that the Board of Trade did not consider that any action on their part under the Act would be of service. The dispute terminated on Jan. 29, 1900; the men resuming work at the old prices."

Equally ineffective, and for similar reasons, was the attempted intervention in the dispute that arose last October between the London lightermen and their employers. "The Secretary of the Lightermen's Society applied to the Board of Trade to take action, with a view to effecting a settlement; stating that the men were willing to submit to arbitration. The Board communicated with the Employers' Association, who, however, declined arbitration. . . . . The dispute subsequently terminated on Jan. 24, 1901, when the employers' interpretation of Lord Brassey's award was accepted." In short, the employers were not prepared to engage men except on their own terms; so arbitration was out of the question. That arbitration can rightly be declined in many cases, some good people appear incapable of comprehending. If A is willing to employ B at 5s. a day, but prefers not to have the work done rather than pay more, why should he submit to arbitration B's demand for 6s.—especially considering that the arbitrator is most likely to split the difference and say that 5s. 6d. would be a fair rate? A has an offer to make, and if B prefers to decline it, well and good; but there is nothing upon which A can be considered to be morally bound to arbitrate. There would be if B were compelled to work for A.

Arbitration is a convenient method, at times, of determining by a less disastrous method than a strike or lock-out what is the market value of the particular class of labour in question; and the increased resort to that method of late years is to be welcomed. But its sphere of action must necessarily be limited; and nothing will do more to injure the prospects of its continued and extended employment within that sphere, than any attempts made to use a refusal of employers to submit matters to arbitration which do not lend themselves to that method of settlement, to prejudice the public in favour of the men. That is a common manœuvre of Trade Union Secretaries when things are not going well for the Union.

The dry, official language of the report before us, at times (doubtless without consciousness) borders upon the humourous. "On May 29, 1900, the Secretary of the National Union of Gas Workers and General Labourers applied to the London, Brighton, and South Coast Railway Company on behalf of the quay workers employed casually by the Company at Newhaven, for an advance in wages from 4½d. to 5d. per hour. The Company refused to negotiate with the Union; and on Aug. 6 the men struck work without notice. . . . On Aug. 30, the Secretary of the Union wrote to the Board of Trade offering on the part of the men to submit the matter to arbitration [not, it will be noticed, before declaring a strike, but after it had completely failed]. An officer of the Department had an interview with the Manager of the Company on Sept. 3, and then ascertained that the latter had already

engaged on the permanent staff a sufficient number of men to carry on the work, and that it had been decided on no account to re-engage any of the former employees. Under these circumstances, the Board of Trade were of opinion that no useful purpose could be served by action on their part; and the Secretary of the Union was informed accordingly." This last paragraph is a very neat description of the complete discomfiture of the Union—whose offer "to submit the matter to arbitration," after having put the Company to the maximum of inconvenience, was a pretty piece of impudence—and the virtual snubbing of the Board of Trade. We do not imagine that the interview between the "officer of the Department" and the Manager of the Company, was a very prolonged affair.

The total number of cases dealt with by the Board of Trade since the Act came into force reached, by June 30 last, 113 only, of which 46 occurred the two last years. In 42 disputes a joint application was made to the Board; in only 16 cases did the employer apply; while 46 applications were made by the workmen. In 9 cases, the Board took action upon their own initiative. Of the total of 113 cases, 70 were settled under the provisions of the Act; 10 others were settled between the parties during the negotiations; while in the remaining 33 cases either no settlement was arrived at through the Board's intervention, or the Board "declined to take action"—as in the case just quoted. By far the largest proportion—more than a third—of the total number of disputes referred to the Board occurred in the building trades. No really serious disputes were settled by means of the Act, which cannot, indeed, be considered a very valuable addition to the Statute Book.

ELECTRIC LIGHTING MEMORANDA.

The Hackney White Elephant—Another Dynamo and Dust-Cart Combination—The Cost of "Free" Wiring—The Sad Case of Shoreditch.

ANOTHER of those luxuries of the poor Metropolitan ratepayer called a municipal electric lighting undertaking, was formally opened last week. This time it was Hackney which rejoiced officially at the birth of the white elephant. We learn from the newspapers which profess the cult of municipalism, that this venture completes the dazzling chain of municipal electric lights which stretch across the northern heights of London. How gratifying for those who do not desire that the rates should ever be less! But when some pervervid advocates of municipal trading are making out a case for their side, they are not too particular as to the quality of the proofs they sweep together. Thus, in one journal of this brand, whose zeal is not always according to knowledge, "municipal" electric lighting is made to include the amazing performance of the old St. George's, Hanover Square, Vestry—"an arrangement having been made with a local Company by the old Vestry just prior to its abolition." It was so, indeed; but we should never have classified such an "arrangement"—some might substitute a harsher word—as municipal lighting. In this sense, all the London Gas Companies are equally agents of Municipalities, since they all have street lighting contracts; but not, unhappily for them, at the St. George's, Hanover Square, figure. Possibly it is the extravagant price put into the contract which gives the "arrangement" the true municipal flavour.

To return, however, to Hackney, which is a far cry from the West-end, where people deal in luxuries. There was a great hubbub once upon a time over the question of whether the old Vestry were to work their Provisional Order themselves, or lease the powers to one or more companies. The outcry was, of course, largely manufactured in particular interests; and eventually Mr. Robert Hammond secured the job of equipping the district with an electricity works in conjunction with a refuse destructor. The "Standard" of Friday last described this combination as "the interesting feature of the whole scheme." As though the idea were novel! Doubtless, the combination has proved interesting in one sense to the engineer and the contractors; and it will interest the ratepayers in another sense by-and-bye. This will not be yet, however; as this part of the plant is not complete. But there is enough in sight to occupy the attention of the Borough Council. They are going to sell electricity at 4d. per unit for lighting, which, as the newspapers say, is lower than the price charged in any other Metropolitan Borough. As there does not appear to be any special reason why Hackney electricity should cost less than the same manufactured article in other parts of the Metropolitan area, this decision can only mean that the Hackney ratepayers are going to drop more money over it than their less Progressive neighbours. But then, Hackney electricity is so good that 8 units of it are about equal to 1000 cubic feet of gas! That, clearly, shows that there is no sacrifice of quality to price.

In order that the Hackney population may not be prevented by the usual difficulties from availing themselves of the advantages of the electric light supplied at under cost price by the Borough Council, they are favoured with a "free" wiring scheme, the leading feature of which is that they will pay 5½d. per point per quarter for the fittings. Seeing that the cost of wiring per point is not likely to exceed 10s., and may be less, this is not a bad specimen of what the modern business man means when he offers to give anything away. An annual return of 3s. 8d. in the pound on contract prices, which themselves cover a decent tradesman's profit, is clearly good philanthropy. The consumer, however if he awakens to a sense of what his "free" wiring is costing him, will have the option of paying for it at the stated cost price, *plus* 25 per cent. Again, not bad for a "gratis" enterprise? Many a smart commercial firm we wot of would like to get a foothold in a likely neighbourhood on similar terms. But the trouble is that municipalism is not prevalent everywhere; and where it does not exist, the public only have to pay the ordinary market prices for these things. It is rather a striking coincidence that, while Hackney was, as we have said, officially rejoicing over its new blessing, with a dinner at the Hotel Cecil for the favoured few—the common people seem to be left out in the cold—the figures relating to the experience of Shoreditch of the "interesting" combination of electricity generation and dust destruction were spread out to the world in the pages of the "Electrical Review."

This is what our contemporary has to say concerning the Shoreditch returns: "The accounts of the Shoreditch electricity and refuse destructor undertaking for the year ending March 31, 1901, will prove an unpleasant surprise to the advocates of such combinations in general, and in particular to those who are specially interested in this Metropolitan enterprise. It has for several months been stated that the past financial year would show a loss of two or three thousand pounds, and the abstract of accounts which has just been issued exhibits an actual deficit of £3266." The abstract in question is given in the "Electrical Review" for the 25th ult., p. 692. The capital outlay on the whole establishment is roughly £200,000, or a little less than the cost of the Hackney scheme. Try as they might, the Committee could not get the expenditure on revenue account for the year below £27,008, to earn an income of £30,862, whereof £5748 was for public lighting. The gross profit balance shown by this account was therefore £3854. The profit for the year before was £6206. The interest and sinking fund payments alone require £7600 a year. It is true that the cost of coal rose from £5487 to £10,996; but is not this a refuse-burning establishment? The portion of the accounts relating to the refuse destruction is incomplete. It always is. At Hackney, it is the destructor plant itself which is unfinished; but we make bold to predict that ten years hence the uncertainty as to the true performance of these combined plants will continue. St. Pancras showed the way to drop this inconvenient complication years ago; but the last engineer's commission has not been paid upon them.

WATER ACTS FOR 1901.

(*Continued from p.* 1090.)

THE Aldeburgh Corporation (Water) Act empowers the Corporation to acquire the undertaking of the Aldeburgh Water-Works Company, Limited, and to supply the borough and the parish of Sudbourne, Suffolk. The consideration for the purchase is £5000, out of which the Corporation may retain enough to pay off any mortgage debt and interest thereon outstanding on the day of transfer. New water-works are authorized, including a pumping-station and wells in a stated part of the parish. When this station is fit for service, the Corporation are to cease supplying water from the existing wells of the Company. Rates for domestic supplies range from 7½ to 6 per cent. on rateable value. The sum of £7000 is to be borrowed for water-works extensions.

The Aspatria, Silloth, and District Water Act constitutes and incorporates a Joint Water Board for the Urban Districts of Aspatria and Holme Cultram, Cumberland. Four members from each District Council are to constitute the Joint Board, with an outside Chairman, subject to the usual provisions in such cases. The authorized water-works comprise a compensation reservoir to be formed by means of a dam across the end of Overwater Lake, and cuts and dams for taking water from the River Ellen. Various landed and railway interests are protected. Compensation water is to be discharged into the River Ellen at the rate of not less than 440,000 gallons a day, so long as the Board draw their supply from this source. Fish passes are also to be provided. The works are to be completed within seven years. Each of the contributing authorities is entitled to the water obtained by the Board on the following scale: Aspatria, 270,000 gallons per day; Holme Cultram (Silloth), 330,000 gallons. Any excess supplies are to be charged for; in the former at the rate of 2½d. per 1000 gallons, in the latter 3d. per 1000 gallons. The rate for domestic supplies is 5 per cent., subject to 15 per cent. discounts after the undertaking pays the full interest on the cost. The sum of £35,000 is to be borrowed for the construction of works, and £3000 for working capital. Surplus profits are to go in reduction of the charge for water, when and as circumstances shall permit the same to be done.

The Biggleswade Water Act constitutes a Joint Board representation of the Biggleswade Urban and Rural District Councils for the supply of the district. The Board is to be formed of twelve members, six from each authority, or thirteen when the Chairman is not appointed from among the members. The first Chairman is named, and is to hold office for three years. If the Rural District of Sandy should be formed into an Urban District it is to have a member on the Board; and the representation of the Rural Council is thereupon to be reduced to five. The authorized works comprise a pumping-station and wells in the parish

of Biggleswade, and a reservoir on Toplers Hill. The Rural Council are to make their own pipe-lines. The works are to be completed within five years. The Corporation of Bedford are not to be opposed if in the next two sessions of Parliament they promote a Bill to estabish water-works at a distance of not less than two miles from the authorized well. Both constituent authorities are to have as much water as they require, provided that in case of shortage the proportions are to be shared according to the populations. Rates for domestic supplies range from 7½ to 6 per cent. Certain supplies may be by stand-pipes. The sum of £37,400 is to be borrowed by the Board for water-works purposes, and £1500 for working capital. The Urban Council may also borrow £4000, and the Rural Council £41,000 for water-mains. The Board may issue stock. Other parishes may from time to time be added to the district.

The Broadstairs and St. Peter's Water and Improvement Act authorizes the Urban District Council to purchase the undertaking of the Broadstairs Water-Works Company and to construct additional water-works for the supply of their district and the parish of St. Peter Extra, in the rural district of the Isle of Thanet. The transfer is in accordance with the terms of a scheduled agreement. Additional works are sanctioned, comprising an adit from the existing well of the Company at Rumfield, running 4580 feet in a north-westerly direction, and another adit running 1390 feet in a south-easterly direction. The Corporation of Margate have a clause protecting their interests in regard to the first-named adit. The works are to be completed within five years. The rate for domestic supplies is 6¼ per cent. upon the gross estimated rental. The sums of £12,000 and £18,000 are to be borrowed for water-works purposes, in addition to the purchase money for the Company's undertaking.

The Ilkeston and Heanor Water Act constitutes a Joint Board representation of the Corporation of Ilkeston and the Heanor Urban District Council, with power to acquire the undertaking of the Meerbrook Sough Company, and to construct works for intercepting and distributing the waters of the Meerbrook Sough. The Joint Board consists of thirteen members; eight to represent the Corporation and five the District Council. The sale of the undertaking of the Company is by a scheduled agreement; the price being £5000. Additional works are authorized. Not more than 3 million gallons of water per day are to be taken from the Meerbrook Sough, the remainder being allowed to discharge into the River Derwent as heretofore. The works are to be completed within seven years. The disposal of the new supply is regulated by numerous clauses going into great detail; and there are a number of clauses protecting various interests. The sum of £6000 is to be borrowed for the purchase of the Company's rights, and £106,500 for other water-works purposes, with £5000 for working capital. Rates for domestic supplies range from 7½ to 6 per cent. The local authorities outside Ilkeston and Heanor who have a right to demand a supply of water from the Board are named in a schedule.

The Llandrindod Wells Water Act authorizes the District Council to purchase the undertaking of the Water Company, who were incorporated in 1884. The limits of the Act are the district and the parish of Llandrindod Rural, and such portions of the parish of Llanbadarn-fawr as lies to the south of the River Ithon, in Radnorshire. The transfer is to be by arbitration; the Umpire, in case of difference, being appointed by the Board of Trade. Certain particulars governing the value of the undertaking are specified for the consideration of the Arbitrators. The mortgage debt of the Company, and the interest thereon, must be paid by the Company before the date of the transfer. Additional works are authorized, including a reservoir to be formed by an embankment on the Careg-Wiber bank, for collecting the water of the Howey Brook. The compensation water is to be 10,000 gallons per day. The Conservators of the Wye Fishery district are protected. The works are to be completed within eight years. The rate for domestic supplies is 6 per cent., subject to discounts of not exceeding 15 per cent. Sums of £10,800 and £4000 are to be borrowed for water-works purposes.

The Prestatyn Water Act authorizes the Urban District Council of Prestatyn to purchase the undertaking of the Dyserth, Meliden, and Prestatyn Water Company, which is a proprietary concern with a privately-owned capital of £5000. The terms of transfer are stated in a schedule; the price of the property being £7750. The stock in trade is to be taken over and paid for within ten days of the transfer. Additional water-works are to be constructed, including a pipe line for taking the waters of the spring known as Ffynnon Asaph, in the parish of Crom, Flintshire. The quantity of water to be so taken is limited to the capacity of a 4-inch pipe, under stated circumstances. The works are to be completed within three years. The Nant Pool is not to be taken. Rates for domestic supplies range from 8 to 7 per cent. Sums of £5000 and £4000 are to be borrowed for water-works purposes, besides the amount necessary to purchase the undertaking.

The Southport Water (Transfer) Act constitutes and incorporates a Joint Water Board, consisting of representatives from the Councils of the Borough of Southport, the Urban District of Birkdale, and the Rural District of West Lancashire, and transfers to such Board the undertaking of the Southport Water-Works Company. The Act was promoted in accordance with the Southport Water Act, 1890, which contained a clause contemplating this proceeding. The outside water limits defined by the Act are all within the rural district of West Lancashire. The constitution of the Joint Board includes six members to be nominated by the Corporation, four members to be appointed by the Urban Council, and two members to represent the Rural Council, four to be a quorum. The transfer of the undertaking is according to the terms of a scheduled agreement. Officers and servants of the Company injuriously affected by the transfer are to be compensated at the rate of one-sixtieth part of the annual amount received for every year of service, commuted at 3 per cent., in accordance with the Carlisle Mortality Table. The debenture stock issued by the Company remains a first charge on the undertaking until discharged. The Board may, by agreement with any shareholder of the Company, issue to him, in lieu of purchase money, an equivalent amount of redeemable stock of the Board. The pressure of water is to be the same in Birkdale as in Southport. Rates for domestic supplies range from 7½ to 5 per cent. Metered supplies are chargeable at the price of 2s. per 1000 gallons. An agreement between the Corporation and the Rural Council is scheduled and confirmed. Besides the purchase price, the Board are authorized to borrow £15,000 as working capital. The former loan is repayable in fifty years. Surplus water profits are to be applied in reduction of the water rents and charges when and as circumstances shall permit the same to be done; but the Board may retain at the close of any financial year so much of the surplus as they shall think necessary for the purpose of carrying on the undertaking and paying the current expenses connected with it. The price of the property is £756,000, besides the amount of the irredeemable debenture stock.

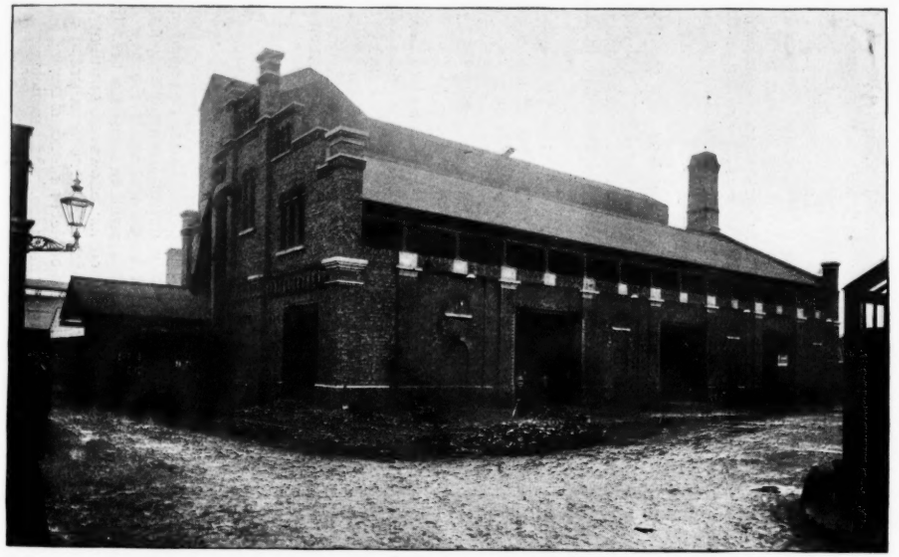
The Stratton and Bude Improvement Act enables the District Council to acquire the undertaking of the Bude Harbour and Canal Company, with the object of converting the canal into a source of water supply for the district. The price of the undertaking is £8000. Mr. E. Mucklow, who has taken water in bulk from the Canal Company, is protected by special clauses. The area of supply is the district and several adjoining parishes. The flow of the River Tamar, which is the ultimate source of supply, is not to be interfered with. Additional works are authorized, including a trunk main from the canal to the filtering-beds and service reservoirs in Pancrasweek parish. The works are to be completed within five years. The rate for domestic supplies is 10 per cent., with discounts up to 15 per cent. Loans of £16,700 and £2000 are to be borrowed for water-works purposes. Surplus water profits are to go to the district fund.

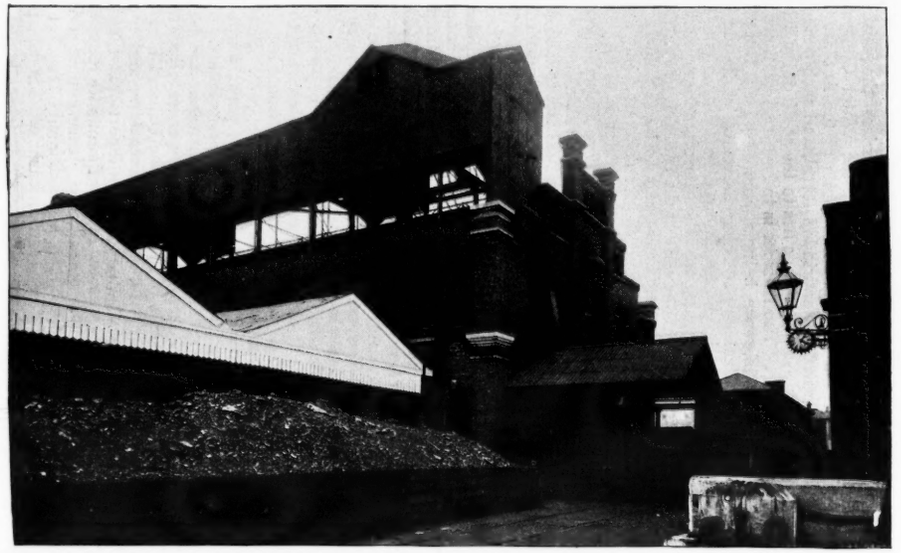
The Wells Corporation Water Act empowers the Corporation to purchase the undertaking of the Wells Water Company, Limited. The limits of the Act are the city and the parishes of Saint Cuthbert Out and Wookey, in the county of Somerset. The supply in the latter parish must be made effective within five years. Outlying local authorities may purchase their portions of the undertaking under the Public Health Act, 1875. The undertaking is to be purchased by arbitration, to be commenced within six months of the passing of the Act. Officers and servants of the Company are to be compensated. New works are authorized, including a storage reservoir at Holes Ash, in the parish of Cuthbert Out. The works are to be completed within five years. The rate for domestic supplies is 5 per cent., with a minimum charge of 1s. 6d. per quarter. Certain supplies are to be metered. The rating clauses are very simple. The Corporation are empowered to borrow the price of the property, and £10,000 additional. Surplus water profits are to go to the district fund. An amended agreement between Lord Brougham and Vaux and the Corporation, for the continued use of certain springs of water granted to the Wells Water Company, is scheduled.

At this evening's meeting of the Institution of Civil Engineers, at 8 o'clock, the President (Mr. Charles Hawksley) will deliver his Inaugural address, the presentation of the Council's awards of prizes and premiums will take place, and there will be a reception in the library afterwards.

According to the last annual report of the Local Government Board, the outstanding loans to local authorities at the close of 1900 amounted to £276,229,048, of which a sum of £110,000,000 is invested on reproductive undertakings. In the first-named total, gas-works figure for £19,247,026, electric lighting works for £5,251,504, and water-works for £49,795,662.

The current number of the "Engineer" contains a long description, illustrated by diagrams, of the new pumping-engines of the Southwark and Vauxhall Water Company at Hampton, which were illustrated in the "JOURNAL" for May 7 last (p. 1225). It is based mainly on drawings and particulars furnished by the Company's Engineer (Mr. J. W. Restler, M.Inst.C.E.); and it concludes with the results of trial runs of one of the engines, which were erected by the North-Eastern Marine Engineering Company. A test, extending over twelve hours, was made on the 29th of June, with the following result: Amount of feed water used per hour, 7536 lbs.; jacket water do., 478 lbs. (total, 8014 lbs.); average indicated horse power, 553·2; water per do., 14·48 lbs. During the test, however, one of the other engines had to be put to work, and continued running for seven out of the twelve hours. A further test, extending over six hours, was made the next day, when a better result was obtained, as will be seen from the following figures: Average horse power, 562; total average water (feed and jacket) used per hour, 7894 lbs.; water per indicated horse power per hour, 14·05 lbs. The contract specified the water per indicated horse power per hour at 14 lbs., which was practically obtained.





THE CONVERTED RETORT-HOUSE AT LOWER SYDENHAM.

From various quarters, we learn with pleasure that the article in the "Journal" for the 22nd ult., in which we narrated the observations made during a visit to the inclined retort-house at the works of the Crystal Palace Gas Company has created a good deal of interest. Many there are among our readers who give full credence to the statements then made; there are others who seem possessed by a kind of latent doubt, to which they do not care to give open expression, as to the uniform free working of these settings; and we have come across a few engineers who cannot make some of Mr. Shoubridge's figures conform with their own working. To the first class, we bave, of course, nothing to say. To the second, the remark must be made that we cannot go behind the statements in the article, simply because there is nothing to go behind them for. The article presents a true and unembellished account of what was actually seen at the time of the visit; and so there is nothing more to say. However, let those who may have any doubt obtain permission to go to the Sydenham Gas-Works, and see for themselves. Their scepticism may be simply due to bad impressions in the course of visits to one or two other installations; and a journey to Sydenham may act as an antidote. At the same time, let it not be imagined that we are holding the Sydenham installation up as the one and only one in the country which possesses the virtue of working as nearly automatically as it is possible to make inclines work. It only happens that special circumstances directed our footsteps to Sydenham. Then as to the figures, it will not be out of place to ask critics to again peruse the portion of the article just preceding the tables, and to take into consideration the conditions which adversely influence the cost of the working of these inclines. If, after giving full weight to all points, there is anything which is considered to be open to criticism, we will give place in our columns to the views of correspondents.

The dull weather which prevailed during the week preceding the publication of the article prevented Mr. Shoubridge securing all the photographs which we desired for illustration purposes. At our request, however, he has obtained further views, which show the simple and economical manner in which he converted the old house into one suitable for the inclined settings. It will be remembered that, instead of carrying the whole roof up to the full height required for the inclined system, he simply ran a light roof

from the front outside wall to the buckstaves of the bench; and then constructed an elevated covering of corrugated iron for the storage hoppers and conveyors on the charging side of the house. The first illustration shows the lower portion of the roof from the front outside wall; and the second illustration depicts the elevated part over the charging-floor. As we previously stated, we do not know of any other instance in the country in which such a simple plan of converting a house from one system to the other has been adopted; and therefore we consider it worth illustrating. The third picture presents one of the inimical conditions to the highest achievement from the settings—that is, the necessity which exists (owing to the peculiar situation of the house) for wheeling away the coke, and which impedes the charging and discharging of the retorts.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1188.)

BUSINESS on the Stock Exchange last week was on a very restricted scale; and the tendency to abstain from dealing was enforced by the closing of the Exchange on Friday—the customary 1st of November holiday. The dearness of money was the most potent factor, and prices fell before obligatory sales. The "disagreeable incident," too, reported from the seat of war on Saturday helped to make the tone heavier. The only exception was in the American Market, which was firm. In every other department, there was a fall though not an excessive one. The Money Market opened very tight; but soon afterwards the pinch was so much relaxed that forecasts as to the likelihood of a change in the Bank rate on Thursday were about equally divided. However, it came; and the 3 per cent. rate, which had lasted from the 13th of June, was raised to 4 per cent. Business in the Gas Market was quite lively; and there was a great deal more done than has been the average for some weeks past. But it was to a very great extent restricted to the issues of the leading Company; and if these be eliminated, then the volume of business was indeed moderate. There were hardly any changes in the quotations; and they had no remarkable significance. In Gaslights issues, the ordinary was dealt in to an extremely large extent, as things ordinarily go, especially on the opening and closing days. The prices marked were on a dead-level all through, never varying much above or below 98. The secured issues were fairly dealt in; and prices did not seem to suffer from dear money. The tendency recently shown by South Metropolitan to relax came to a head last week, and the quotation was lowered a point; but the last transaction was at the best figures of the week. Commercials were quiet and unchanged. Hardly anything was done on the London Exchange in Suburban and Provincial issues; but a good amount was disposed of at the Mart on Monday. In the local market, Liverpool had a rise—the only change made in the week. A little business was marked in the Continental Companies. Though quiet, they were strong; and Union advanced 2 points. None of the undertakings in the remoter world offered any noticeable feature. In the Water Companies, business was of about its usual modest proportions. There was some indication of a slight reaction in prices after the recent remarkable advances, which the dearness of money probably had something to do with; but the only actual change in quotation was a fall in Lambeth tens.

The daily operations were: Great activity in Gaslight ordinary on Monday, and quieter business on Tuesday. Quotations did not vary. Moderate business on Wednesday, more evenly distributed. South Metropolitan fell 1. In Water, Lambeth tens fell 3. Thursday was almost a counterpart of the preceding day; but Continental Union improved 2. On Friday, the Stock Exchange was shut. Saturday was the briskest day of the week. Business was almost wholly in Gaslight ordinary; and quotations closed unchanged.

Incandescent Lighting by Petroleum.—A communication was presented a short time ago to the Charleroi Section of the Association of Engineers from the School of Liège, by M. Beco, a mining engineer, on the Washington system of incandescent lighting by means of petroleum. The oil is stored in a sheet-iron receptacle, fixed in the building to be lighted, and sent under pressure to each point of consumption, where it is vaporized. The vaporizer is a vertical steel tube, lyre-shaped, placed in the centre of three mantles, and heated by them. Before lighting the lamp, it is necessary to heat the vaporizer, which is done by means of alcohol flames beneath the burners. After it has been once started, the lamp is said to burn with regularity. The type usually employed (750-candle power with three mantles) is reported to give the same light as an electric arc lamp of 8 amperes, while it is better diffused, seeing that its source is three luminous mantles instead of a single bright point. The drawbacks to the system, as far as its use for interior lighting is concerned, are the whistling noise that is caused by the combustion of the oil, and the heat generated; but for outdoor construction work it might be found useful. The cost is less than that of electric lighting in the case of an average installation running for less than 3000 hours per annum. According to some experiments carried out for the Northern of France Railway, the 750-candle lamp does not consume more than 270 grammes, or about 9½ oz., of petroleum per hour.

PERSONAL.

Mr. C. P. CLOWES, Assistant-Manager of the Gorleston and Southtown Gas Company, has been appointed, out of a large number of applicants, to a similar position at Dorking. Before leaving Gorleston, Mr. Clowes was presented by the employees of the Company with a handsome timepiece, as a token of esteem.

Mr. HENRY MILES, one of the senior collectors in the Birmingham Corporation Water Department, having attained the age of 65 years, retired on superannuation at the end of last month, when a presentation of a handsome bookcase was made to him by the members of the official staff. The presentation was made by the Secretary (Mr. E. Antony Lees), and Mr. Miles feelingly acknowledged the gift.

We regret to learn that, owing to impaired health, M. GODOT, the General Manager of the Paris Gas Company, has been compelled to resign; and the Directors have appointed M. BERTRAND, the Deputy-Manager, as his successor. The promotion of the last-named gentleman will involve other changes among the higher officials of the Company. M. DE MONT-SERRAT will take M. Bertrand's place; M. SAUM becomes Outdoor Superintendent; and M. GAUDRY is appointed Chief Engineer of the Lighting Services.

The paper which Mr. SAMUEL CUTLER, jun., M. Inst. M.E., read before the Institution of Junior Engineers, in March last, on the subject of "Carburetted Water Gas," secured the Institution premium. The paper, it may be remembered, dealt very exhaustively with the subject, and in a manner which could not fail to attract the interest of both hearers and readers. Mr. Cutler had the honour of receiving the premium at the inaugural meeting of the new session last Friday, from the hands of the retiring President, Sir Lowthian Bell, Bart. The members of the Institution have placed Mr. Cutler on the Council.

OBITUARY.

The death is announced of Mr. CHARLES BOWER, of Buttershaw, formerly of Low Moor—father of Mr. Thomas Bower, of West Hartlepool, and Mr. W. Ackroyd Bower, of Normanton—a gentleman who had had a very long and close connection with public affairs in the North Bierley district. Although he had reached his seventy-ninth year, Mr. Bower was of such exceptionally strong physique, and had enjoyed such good health, that many years of life seemed yet in store for him. A few months ago, however, his health declined; and after severe suffering he died of disease of the heart. He was the eldest son of a family long connected with the Low Moor Iron Company, at whose works he served an apprenticeship, remaining with the Company up to 1866, when he became Manager of the North Bierley Water-Works Company. When this undertaking was taken over by the North Bierley Local Board, he assumed the additional position of Surveyor, discharging the dual duties up to his retirement into private life in 1889.

After a prolonged and trying illness, Sir WILFORD BRETT passed away last Wednesday, and the intelligence will be received by the shareholders of the Buenos Ayres (New) Gas Company with unfeigned regret. It was as the Chairman of the Company from its inception that Sir Wilford's name was principally brought before our readers; the last occasion on which he presided being at the annual meeting of the Company in 1899. It was, at the following meeting, the sorrowful duty of Mr. F. J. Heseltine, his successor in the chair, to have to announce the retirement of Sir Wilford from the position on account of ill-health; and there was no mistaking, from the remarks made at the meeting, the genuine feeling of regard which the shareholders bore for their late Chairman. In that capacity, he took more than a superficial interest in the work of the Company; and he was a clear exponent of its affairs when addressing the shareholders. The confidence between Chairman and shareholders was mutual. Among the few other undertakings with which he was connected in a directorial position was the Chelsea Water-Works Company. Sir Wilford was born in 1824, and was brother to the late Lord Esher, the Master of the Rolls.

NOTES.

Acetylene Black.

It has already been recorded that one of the most useful applications of acetylene in the arts is as a source of pure lamp-black. It is stated by M. Dépierre that calico printers are becoming appreciative of acetylene black, on account of its freedom from hard and gritty particles, and its regular composition. It is prepared by igniting acetylene in a closed vessel by means of an electric spark; for, as Lewes exhibited long ago, it is a property of acetylene to be self-burning, without requiring the addition of oxygen, upon ignition by some outside source of heat. This internal reaction is accompanied by the production of dense smoke. Industrially, the operation is conducted as follows: A gas-tight vessel is exhausted of air, and filled with acetylene to a pressure of 2 atmospheres. The charge is then decomposed, either by a spark or a hot wire, when every cubic metre of the gas yields the same

volume of hydrogen and 1 kilogramme of the black. The latter is 99·8 per cent. pure carbon. It is very soft and light; can be made into a paste with water after being allowed to soak in it for some little time; and is miscible in all proportions with oils, gums, gelatine, and other vehicles of black pigment. Diluted with a suitable solution, as albumin, it will give any desired shade of grey; being remarkably intense and equal in quality. This unexpected application of acetylene appears likely to grow in importance, and possibly to keep the factories going. It is interesting to remark that this use of acetylene has sprung into existence since the publication, in 1900, of Lewes's work on acetylene.

Hempel's New Gas Calorimeters.

Herr W. Hempel has described in a German journal two instruments devised by himself for testing the heating value of fuel gases. He admits that Junker's calorimeter gives very satisfactory results when a considerable quantity of the gas, of uniform composition, is available for the determination. It does not answer, however, for small quantities of about 2 or 3 litres of gas, and is therefore not suitable for following the changes in composition which often occur in the course of a few minutes during the process of gas production. Consequently the author has made an apparatus by which the contents of a bottle of gas can be burnt with oxygen inside a tube containing 500 cubic centimetres of water. The current of gas is ignited by means of a tiny flame of hydrogen, which is generated for the purpose, and also for standardizing the instrument. For example, the author found for one bottleful of hydrogen an average rise of temperature in the water of 10·838° C. On testing a sample of producer gas in the same way, the rise of temperature of the water was 4·21° C. Atmospheric pressures and temperatures of the samples being the same, the comparative calorific power is a matter of simple calculation. Taking the absolute calorific value of a litre of hydrogen as 3087 calories, that of the sample is 1239 calories. For the continuous control of gas manufacturing operations, Hempel has devised a flame calorimeter, which is a modification of the jet photometer. It is based on the principle that the greater the heating power of the gas, the longer is the flame, because a greater quantity of oxygen is required for its combustion.

The Disappointing Metal.

From a British Association paper on aluminium, by Professor E. Wilson, and the subsequent discussion, a good deal of information is to be gained respecting the disappointing sluggishness of progress in commercial applications of aluminium. The author pointed out that, so far as is known, aluminium does not exist uncombined in the metallic state; being essentially a product of chemical industry. Aluminium can be used to produce an enormous number of alloys, some of which containing 1 to 2 per cent. of other metals, combine the lightness of aluminium with greater hardness and strength. On the other end of the scale, alloys containing from 90 to 99 per cent. of other metals exhibit properties of those metals, but much improved for certain purposes. Unfortunately, it is when aluminium is used alone that its chief recommendation—lightness—is found to be counterbalanced by other considerations. The efforts that have been made to use aluminium wire for telegraphs and telephones have not been very encouraging, owing to the uncertain texture and weakness of the drawn wire. The same difficulty occurs with tubes and sheets of the metal. No guarantee of strength can be obtained from the manufacturers short of thicknesses far in excess of what would be required of copper and still harder and tougher alloys. There is, consequently, no advantage in using the lighter but more uncertain and costly metal. The chief advantage of commercial aluminium appears to be for the construction of cooking utensils. A great difficulty is found in soldering the metal; and it will not stand salt water. On the whole, therefore, aluminium must be classified by practical men as a disappointing metal.

Railway Carriage Lighting by Rich Gas and Acetylene.

Up till comparatively recently, the majority of the carriages of the Paris-Lyons-Mediterranean Railway Company were lighted by rich gas, made from cannel at the central station of the Company at Bercy-Donanes. On the suggestion of the Engineers, however, it was decided to employ for the purpose a mixture of this gas and acetylene, in the proportion of 75 per cent. of the former and 25 per cent. of the latter—this combination having been found highly satisfactory in the lighting of several stations. Works for the production of the new gas were accordingly erected in proximity to the cannel-gas plant; and the entire installation was described, in conjunction with a plan, by M. Guérin, Inspector of Lighting and Heating to the Northern of France Railway Company, in a recent number of "Le Génie Civil." Each of the gases as made goes through a meter, the outlet from which ends in a single pipe which receives the mixture. The gas-meter is equal to passing 3300 cubic feet, and the acetylene-meter about 1100 cubic feet per hour. Their capacities are consequently in the proportion of three to one. On leaving the meters, the mixture flows into two gasholders, each of 3500 cubic feet capacity, whence it is conveyed into accumulators, which it leaves under a pressure of 22 lbs. The volume of mixed gas distributed for carriage lighting is about 71,000 cubic feet per 24 hours; its illuminating power being 12 candles, with an hourly consumption of 0·88 cubic foot. The works at Bercy-Donanes have been in use for some little time; others, on the same lines, have been erected at Marseilles, and have been running since July 15.

COMMUNICATED ARTICLES.

THE ECONOMICAL ADVANTAGES OF INCLINED RETORT-SETTINGS.

By W. R. Herring.

I am afraid that the ultimate issue of the differences of opinion prevailing with regard to the economical advantages of inclined retorts, both from the capital and manufacturing costs point of view, has not been greatly assisted by the attention it has recently received; and that the primary object of the paper which I contributed to the proceedings of the International Engineering Congress, expressing a hope that at least some of these might be settled, has not been achieved. The short time at the disposal of the Chairman when the paper was read, prevented many who had had a more or less lengthened practical experience of the system from adding their say to what transpired on that occasion; and my object in again reverting to the matter is to endeavour to persuade them to place their experiences on record now, and enable the profession to get at the bottom facts of what, to me, has been the most important problem in the gas industry during the past ten years.

I propose, first, to revert to the "Editorial Note" dealing with my paper which appeared in the issue of the "Journal" for Oct. 1. In the second paragraph, there is reference to my paper read before the North British Association in July, 1900, in which I dealt somewhat fully with the various characteristics of the different coals, and their relation to the angle of repose of same, and proceeded to show that the average angle best suited for the many differing characteristics of the material to be dealt with rendered it almost impossible that the same angle would be suitable for the automatic discharge of the coke. I therefore stated that it was absolutely necessary "that the angle of retort should be such as to permit of the coal lying evenly on the bed of the same without moving. Such an angle in the majority of cases is sufficient to induce the coke to run without some exterior force being applied." I proceeded to suggest that there were instances when the charge required a mere pricking with a poker from the lower mouthpiece, which was "usually sufficient to induce the coke to run from the retort, particularly if the cross section of the retort has been such as to permit of the free expansion of coke without wedging in the crown of the same."

In the last part of the paragraph referred to in your "Editorial Note," you say that an engineer would be justified in not troubling with so questionable a system which possesses apparently irreconcilable differences to ensure a successful working, "*especially in view of the possibilities of horizontal retorts worked mechanically.*" I propose to revert to the portion italicized hereafter, and in the meantime to take up the question of the automatic discharging of inclined retorts. Mr. Shoubridge claims that the system is perfectly automatic in its discharging; and I as distinctly aver, having inspected practically the whole of the inclined systems in this country and abroad, that it is not. Those having experience over a lengthened period with such installations, will be doing a service to the industry by expressing their candid opinions, one way or the other.

In my Congress paper, I suggested that not more than 50 per cent. of the mouthpieces would discharge automatically—meaning that, taking the life of a setting or an installation, about this number of the total charges would be automatically discharged, while the remainder would require some little assistance, small though it may be, sufficient to require the presence of a man on all occasions. There is no question about perfectly new settings running freely; but my mind dwelt rather upon the condition which the practical man usually finds—namely, more or less old ones. Mr. Shoubridge cannot be sincere when he suggests that the whole and sole secret of the automatic discharge is the charging appliances used. He has himself found it necessary to use tapered retorts, and also to attach the greatest importance to the form of the cross-section of the retort. He has further honoured me by adopting the section which I have had working in Edinburgh since 1898, and which was illustrated in connection with my paper in July, 1900.

I also referred to this section of retort, and to the necessity of preserving the same cross-section to the outer lip of the mouthpieces, as far back as May 1 in the same year. The reference to this section in your recent article descriptive of the installation at the Crystal Palace Gas-Works, suggests that it has been adopted for the first time in connection with that installation; whereas the object of this section was clearly defined by me as far back as May, 1900, and in my Congress paper I said that "with such a form the process will become as near automatic as it is possible to have it without introducing additional mechanical devices." This, I think, admits that the process is nearly automatic, but that it cannot be absolutely depended upon, and that occasionally additional assistance must be given to the contents of the retort, in order to ensure its discharge and render it absolutely automatic. I therefore suggest that some further mechanical means can be easily introduced; and while I have not introduced them, my structional arrangements have been devised so as to permit of an application of mechanical force to accomplish this work. This suggestion appears to have seriously affected

Mr. Shoubridge's idea of modern gas manufacturing practice. It is not, however, sufficient to condemn an idea simply because it appears to controvert an academical principle. Surely, as engineers, we are not to refrain from introducing mechanical appliances because superficially they may appear to complicate what is a simple process when performed by hand.

The pick and shovel are simple appliances; but the mechanical excavator—hideous in its appearance, and complicated in its structure—is admittedly more economical, not only in the expenditure of labour, but also in the matter of time required to perform a given operation. If, therefore, it can be shown that a mechanical appliance can be introduced to do what is at present performed by manual energy with the same or superior precision, it matters not how complicated the device may be, it is our duty to adopt it; our very existence as engineers depends upon it. We cease to deserve the title when we refrain from adopting the best possible means of reducing to the lowest minimum the present costs in connection with our manufacturing operations.

The cost of any appliance, or installation, should not be measured by the capital outlay involved in its establishment. This principle has held sway far too long in our country. The Americans have achieved their present pre-eminent position in the world by, so to speak, disregarding the first cost. It is the earning capacity of the money spent, represented by the appliances or installations which should be the governing factor; and provided its earning capacity is sufficient to pay interest charges and a proportionate sum for the liquidation of the capital and maintenance and upkeep of itself, it is our duty to expend the money rather than continue with imperfect plant and pay in wages sums that, in themselves, would be more than sufficient to meet such charges for capital, &c.

Mr. Shoubridge appears to be in this position, judging from your article referring to the Crystal Palace Gas-Works. He admits the necessity of having two men on the charging-stage of his installation. This is the very point I desired to bring out. In my Congress paper, when speaking of the centralized hopper as distinct from the continous hopper system, I said that the localized hopper "necessitates the employment of additional labour to transfer the coal from the storage-hopper to the particular retorts to be charged. There is also considerable loss of time in handling the charging appliances, as the charger has to carry the charge a certain distance in the retort-house," propelled by manual labour. And as your article has it: "The charger being propelled with the utmost ease by the men on the stage, by means of bevelled gearing attached to the travelling wheels." The fact that Mr. Shoubridge requires two men on his charging-stage conclusively proves this.

With the continuous hopper system (either with the attached measuring-chamber or the charger itself acting as such, but not traversing with its load), one man alone is required on the stage, to two men on the drawing-stage. It is one of the two men on the drawing-stage that I maintain can be dispensed with by introducing a simple mechanical device on the charging-stage to give the contents of such retorts as are not self-discharging the necessary start, or impetus, to induce the contents to flow into the coke-conveyor or stage in front. In other words, one man on the drawing and charging stage, in place of Mr. Shoubridge's two men on each stage. As to the structural cost, I have already stated that this depends to a great extent upon the individuality of the designer, as well as upon the local conditions.

The larger question, as to the capital involved in a complete installation, comprising land, buildings, and plant, as compared with a plant of equal capacity worked by horizontal machinery, is one that I am not at the present time prepared to go into; but I may do so at an early date. The principal point at issue at the moment appears to be the relative cost of the continuous overhead hopper system, as compared with the localized hopper. Some of our constructing engineers will no doubt be able to give us very valuable comparisons under this heading; and it is to be hoped that they will place the information they have at the disposal of the "JOURNAL," so that the profession may have the advantages of it. I can, however, give you my own figures relative to the Granton works, from the schedules of quantities and weights, and which I may say have been accepted by the contractors as correct.

The hoppers complete weigh 161 tons 11 cwt.; and they cost £2007 18s. They have a capacity of 800 tons, or (say) 20 hours' supply; the elevating plant working an eight-hour day. These hoppers are supported upon the transverse ties connecting the upper ends of the inner rows of the buckstays. A transverse tie in this position is a necessity, whether the hopper is supported therefrom or not. But to avoid dispute, I will add their cost (269 8s. 8d.) to the former sum of £2007 18s., and thus arrive at the total cost of storage-hoppers and supports for a 1000-ton per day plant of £2277 6s. 8d. Interest at 5 per cent. on this sum amounts to (say) £114 per annum. The hoppers being constructed or a 1000-ton plant, 200,000 tons of coal per annum will pass through them. The result is, therefore, 0·137d. per ton of coal for the capital outlay upon the continuous overhead hopper system, which, upon Mr. Shoubridge's own showing, will enable one man to do what he requires two for.

Surely to argue about capital costs under such conditions is the height of absurdity. Let someone give us the cost of his centralized hoppers. It will be found that the structural cost of one need be no greater than that of the other. At the same time, I again wish to distinctly point out that I look upon the capital cost as of secondary importance to the labour economy on the stage, which, on Mr. Shoubridge's own figures, would be only one-half of what it costs him, and would warrant him expending a further £3600 in the construction of his hoppers—a sum which is out of all proportion to what would be necessary.

I again desire to refer to the last portion of the second paragraph of your "Editorial Note" of Oct. 1 (p. 830), wherein you refer to the possibilities of horizontal retorts worked mechanically. I think I may say that a clear issue has been rendered somewhat difficult, in consequence of occasional statements being made, wherein it is shown that mechanically charged horizontal retorts are being worked at approximately as low, and in some cases at a less, cost than similar installations on the inclined retort principle.

The late Mr. Frank Livesey, in his paper "A Comparison—Stoking Machinery or Inclined Retorts," remarked: "To arrive at the capital required, it will be necessary to decide what amount of work a set of machines is capable of doing per diem per shift;" and he went on to say that "the machine of Messrs. Foulis and Arrol, and those made by West's Gas Improvement Company, are both equal to charging 900 mouthpieces in 24 hours, or 75 charges every two hours, allowing plenty of time for rest between the charges for the men."

Mr. Tysoe, when speaking upon Mr. Carpenter's paper read before the Institution of Gas Engineers in May, 1900, stated that with machinery at his own works the cost, comparing mechanically charged horizontal retorts with inclined retorts erected by Mr. Carpenter, taking precisely the same items, and working under practically the same conditions, was 11·91d.—this figure presumably not including interest and depreciation charges, repairs, and sundries, such as are included in the figures given by Mr. Frank Livesey in his paper already referred to, and from which the following item of costs is taken. It is also interesting to note that, while Mr. Frank Livesey gave the carbonizing wages with machinery at 18·8d., when the machinery was charging 900 mouthpieces in 24 hours, Mr. Tysoe gives 11·91d. when charging 600 mouthpieces.

In reply to a question put to Mr. Tysoe by myself—namely, "Will you give us the minimum amount of the gas made at the works where the cost comes out at 11·91d. per ton of coal carbonized? The machinery must be worked up to its full capacity to give such a result."—Mr. Tysoe said: "To make machinery successful, there must be a large works, and the machinery must be always at work. At my own works, the number of retorts served by one set of machinery amounts to 300—thirty beds of tens" (presumably 600 mouthpieces).

If these statements prove anything, I think it is certain that, under ordinary conditions, machinery cannot compare with the inclined-retort system. Even in the one or two isolated instances where horizontal machinery is worked under its very best conditions, and doing its maximum work throughout the whole year, the labour costs involved are no better than is being achieved by comparatively small installations of the inclined retort. Take, for instance, the installation at the Nelson Corporation works consisting of but a few settings of retorts. The carbonizing wages were certified by the late Engineer (Mr. Alexander Allen), who took charge of the works after their introduction—and who, by the way, has had a most extensive experience with all classes of horizontal stoking machinery—to have been 10·3d. per ton, as against 1s. 5d. per ton when working with the best-known horizontal machinery elsewhere. Testimony such as this cannot be brushed aside lightly; and the status of the profession demands, even apart from the interest of the industry, that as much light as possible should be thrown upon this subject now, so as to enable all to get at the bottom facts of the relative merits of our present systems.

I now desire to join issue with the writer of the "Editorial Note" already referred to, wherein the writer says: "The advantages of inclined retorts, it will on all hands be admitted, must stand comparison, not with what existed at one time, but with anything and everything with which the system might be brought into competition to-day. For example, Mr. Foulis was present when Mr. Herring read his paper; but he kept silence as to the terms upon which he would be able to solve the problem of carbonizing 1000 tons of coal per day." Proceeding, it says: "It would not be by the principle of inclined retorts." Then if not, why not?

The bottom figures ever claimed for a retort-house for a minimum plant of 6 million cubic feet a day, always at work, is, I think, by Mr. Tysoe, and stated to be 11·91d. Mr. Frank Livesey stated it at 18·8d., which latter figure agrees with most of our experiences. The bottom figure claimed for inclined retorts, and certified by a man who has had a very large experience with all sorts of horizontal machinery, is 10·3d. per ton, as against his best work with machinery at 1s. 5d. per ton.

I, among many others, also have my own experience to guide me as to the cost of working the various systems of present-day carbonizing. I therefore contend that the suggestive phrase used by the writer "that the advantages of inclined retorts must stand comparison, not with what existed at one time, but with anything and everything with which the system might be brought into competition to-day" is correct only in the abstract; for the reason that the number of works where the working of stoking machinery is under its best conditions are so few as to completely render its economical introduction inapplicable to the general conditions of the gas industry as a whole. Even our large works, where the

minimum day's output hovers around 5 million cubic feet, invariably have to produce it in two or three retort-houses. On the other hand, it can be shown in several instances that even small works equipped with inclined retorts can compete, and easily beat, machinery working under its very best conditions.

GAS MATTERS IN THE UNITED STATES.

The Influence of the Oil Wells.

Almost daily one sees in the newspaper some reference to the opening up of a new region of country to the use of the manufacturer of oil; and nearly with the same frequency one may read of the establishment of new refineries and distributing points to lessen the cost of traffic in the surrounding country. The effect of this upon the gas-works has been ignored for the most part, as was quite natural; but it is seen dimly by some few men. These men perceive that the present system of teaching a man to use a machine by vote will not serve much longer; and there is as yet no rational theory for using the apparatus. During the summer, I have seen one serious attempt to obtain rational data, to learn to use the oil-gas apparatus scientifically, and to establish a method by which others can do the same. It was with much satisfaction that I heard of a number of other attempts, and learnt how serious were the endeavours to rationalize the methods of working. But the apparatus I saw was much the best and the most scientifically conceived. This was a small gas-works—literally a plant in miniature. It contained its own boiler, a set of retorts (so to say) in duplicate an apparatus for manufacturing oil gas on the Lowe system, as made by the United Gas Improvement Company, together with suitable holders, so that the product could be withdrawn at any time during the process, either for the purpose of analysis or for a test in a large way.

In this plant many curious variations on the details of manufacture have been worked out, and the results noted. Among these, the following in the manufacture of gas by the mixed process, in which usually the quite cold oil gas is mixed with the equally cold coal gas in the proportions needed to make a definite candle power. In this modified process, the two gases are mixed hot; and while at this temperature they are passed through a still hotter checkerwork, by which a further change is made in the physical condition of the gas, which is of importance. The process of making is as follows: The two retorts (call them A and B) are charged alternately. Therefore, assuming that A has been exhaustively heated and the coal therein coked, the processes in being are these: In A, the steam and white-hot coke are making hydrogen and carbon monoxide; in B, that various mixture we call coal gas is in existence. In C, the oil is mixed with the product of A and B. Thence it is led through a white-hot checkerwork to the exhausters, the coolers, and the gasholder. In other words, the processes of decomposition and synthesis are going on simultaneously. Very little study and attention is needed to show anyone how much this process differs from the ordinary system of making mixed gas; the high temperature being the paramount influence.

It would have been sufficient to cause surprise had but one chemical reaction appeared among the constituents, no matter what the reaction might have been; but when so many, and such exactly linked relations appeared, there could be no question in the premises. The present system showed that an improvement was desirable these many years; and the experiments indicated how to plan to attain this improvement. It is safe to assume that some day this machine, and the lessons learned from its use, will be fully exploited. For the moment, I am satisfied with saying that a part of the hydrogen entered into new compounds; and that among those thus formed, at least one entered into metallic combinations. The illuminating power of the gas was very great, and the temperature of the flame was wonderful.

Flame Temperature Studies.

Some experiments on the temperature of the flames of hydrocarbons, and their resulting luminosity, have been made in one of the "small colleges," which exist here for the convenience of students who teach during the rest of the year. These experiments were admirably conceived, and as admirably conducted. Starting with the assumption that the flame of carbon is practi cally non-luminous, and therefore since the luminosity of any flame is due to hot carbon precipitated therein (the temperature of the carbon in a flame can be shown to change with the hue), if a light with a continuous spectrum accompanied by the absorption bands is produced for an instant, it will show that the carbon has been precipitated, the following experiment was worked out. A platinum wire was passed through a tube, and was so arranged that, by passing a current of electricity, it could be heated to any degree desired between the atmospheric temperature and that of fusion. This tube, closed by fusion except at two branches, which were closed by stopcocks of glass, was arranged to be emptied of gas and filled again at will. A spectroscope was fitted for the purpose of examination. The tube was filled with the gas to be examined, and the wire heated by the current. The spectroscope saw only the continuous spectrum of the hot wire, until the temperature of dissociation was reached, when the line spectrum of gaseous carbon would show itself for a shorter or longer time as an absorption band.

The exactness of the method was established by means of certain molecules which break at a very low temperature—by heating them in glass tubes. It was found that the temperature as shown by the wire method agreed with the other if a small correction was applied; and this difference was constant. It was easy to reduce a series of observations made with either process to terms of the other. Both methods were really quite reliable. Many hydrocarbons were examined, and numerous unexpected relations were laid hold of—among others, that the proportion in which the vapours of two hydrocarbons are mixed seriously affects the ignition-point.

One man summed up his results by saying: "Within certain limits, the oil that stands the highest temperature makes the best gas." Another said: "Under the conditions of the experiment, we showed that the mixed method stood at the head, both in intensity of light and in the cost per candle power per hour." Another said: "I made a special study of the questions involved, and used the very best methods; and I had the best instruments going at my command. I am sure that Mond gas is in the same boat with the rest, when compared with gas made by the process which will eventually develop out here. Remember, we have been working with a refuse which on more than one occasion has been a source of danger, and is constantly an expense." Another said: "Soft coal slack is far too valuable as fuel here. After our work this summer, it means horse-power-hours at rates less than those of the best steam-engine." I understand that the questions involved in gas making were discussed in a number of places, and that very important data were obtained. But as yet none is being offered for publication.

The Personality of the Students.

It was noted with surprise by many—especially by the brighter men of the students—that there were among them no "practical gas men." All this study was made in the pursuit of science as such—for the improvement of the minds of the students, not for the benefit of the gas industry. True, these "nothing but college men" could tell you exactly what 1000 cubic feet of gas cost in the mains in numbers of towns and cities, and could give much other information about which the company officials were totally ignorant. But with all their accurate knowledge of the details of the theory and practice of gas making, they were quite without hope or desire for entering the business. To these men, an ambition to displace the steam-engine, and to manufacture a perfect gas to do it with, seemed quite justifiable; but to make gas and use it for illumination, not one of them even thought of it. Probably there is no man in the United States better able to speak on the need of men with a higher grade of skill than is the Manager at Detroit, Michigan; and he voiced the need by saying in my hearing: "Our water gas men run the machine perfectly . . . . and yet they would be more useful if their knowledge was of another sort."

Comparisons of Arc and Incandescent Gas Lighting.

I wish to tell you of some experiments which have been made here in New York by two young men under my supervision. I presume the work will in time be published in full; but the *primâ facie* result is of so much practical importance in the art of "illumination by means of gas," that I cannot but think it well worth the printing. The room occupied by these two young men opens upon a court; and on the opposite side of the court, 105 feet from the window of their room, stands a lamp-post, in which is a lantern containing a double Welsbach light of the ordinary pattern. On the opposite side of the street from the court, at a distance of 276 feet, is an arc lamp.

To obtain an equivalent apparent illumination, these lights should be in the proportion of 11,025 to 76,176, or approximately as 1 is to 7. In the ordinary nomenclature, one of these lights is a 1000-candle power arc; and since its distance value was so near seven, it was taken as seven times unity, and the proposition was made to compare the incandescent gas-light with it. Comparisons were made by mounting two Bardou telescopes, one trained on either light, and throwing a disc of light from each—not an image—one just over the other upon a screen. An arrangement was made for using a spectroscope as a photometer, *vice* the screen; and ray filters were used at various times, and in various combinations. A photographic camera was also arranged, by which a disc of light of the same size cast by the standard pentane lamp at the distance of 1 foot could be photographed simultaneously with either one or both of the others, or its spectrum with theirs. In a word, the apparatus was splendidly designed, and the mechanical construction was practically perfect. Not only could records of equalities and inequalities be obtained in terms of the human senses; but the record in some ways was serviceable for study as a physical experiment into whose record no human feature enters until such record is read.

To begin with, then, the first point on which an equality or an inequality is desired is the expression in terms of some unit of the amount of light received from the two lights at (say) 9 p.m. every night during the year. This was not only the choicest part of the work, but it had in it the basis by which all future work would be guided. In the way in which it was handled, was developed that system of compromise which makes the work unique. While the work has been divided, in no part has the specialization been made so complete as to interfere with the future, so to say, usefulness of the data to either of the men. Thus one of them made nearly the whole of these measures having

in view the comparison of the intensity of the light; the other compared the spectra. But each collected enough of all the data to explain why the conditions of things existed.

The first, and practically the most important, series of data obtained were direct radiation comparisons. From these, it was found that the light inhibition due to wind, wet, fog, storm, and tempest was not uniform with respect to the two sources of radiation. The kind of fog seemed to have a very important influence in determining which of the two lights was to be inhibited. Thus the true cloud fog interfered less with the mantle than with the arc; while a snow storm was more influential in reducing the arc's radiance than that of the mantles. The influence of the flame in restraining the light was wonderfully well shown. Careful manipulation demonstrated that precisely the same parts of the spectrum were wanting in the arc light and in that from the mantle, but in far less degree.

On a number of evenings the opportunity was given them to study the formation of dust storms. Here, again, the machinery for investigating the physical state of the light was most useful. The spectroscope showed that the dust was continually volatilized in the flame giving its characteristic spectrum when examined with due consideration. Naturally this was most frequently successful in the case of the arc; but the lines in the bunsen-flamed Welsbachs plainly showed a number of bases. These two inquiries—the inhibition of light by water and its colouration by dust—are but two among the many interesting items studied; but they are typical, the one of the photometer studies, the other of those made with the spectroscope.

Other Chemical Studies.

Among other studies like those named, made for the philosophic doctorate, may be mentioned certain chemical "studies into the nature of the so-called vapours in illuminating gas." For these studies also fine apparatus has been designed and arranged; and they promise very important results scientifically. Among other things which they expect to show, is the proposition that the vapours yielding to alcoholic solution are really vapours till nearly at the critical temperature. The ordinary results which admit of this interpretation have been re-examined; and now those interested are in pursuit of new data by which the proposition may be extended. Thus, while the routine is continued without change in the technical establishments, others are seeking for new ways of gathering information, and of using it when gathered.

Mr. Pitre and His Twin-Atom Theory in Relation to Illuminating Gas.

This young man bids to make somebody listen, if he can do no more than this; and it would not be very surprising if, after the first listening, some people considered it worth while to listen very patiently a second time. He comes forward with a remarkable series of propositions; and then after you have admitted that certain results would settle the question, he says: "Well, try the experiments." You do so, and they turn out exactly as you have all along predicted they would do; and yet there seems a mistake or deception somewhere.

Mr. Pitre's theory is briefly this—that when carbon monoxide, marsh gas, and hydrogen are mixed in certain proportions, they form a vehicle in which heavy hydrocarbon vapours can be dissolved—as alcohol, or glycerine rather, is dissolved in water; and the specific gravity will bear no rational relation to the amount dissolved. In brief, and roughly, this is the matter in hand and the way of expressing it; but scientifically speaking, the matter is of much importance.

Nearly everybody will recognize the practical bearing of these questions, especially if they are put in the right sort of shape. For example, a gas company are making a gas like that of New York City—legal requirement, 20-candle power for 5 cubic feet. For some reason they find that the enriching material which reacts as a gas at 8°C. deposits as a fluid at 5°C. What is the reason? How is the mischief to be avoided—by adding some gas-like vapour in the place of those now used? Not at all, only be careful that the proportions of CO, H_2, and CH_4 are the best ones for that temperature. By this precaution, not only can all mischief be avoided, but all persons interested will be able (at least, so says Mr. Pitre) to determine in advance the best image and design for the composition of the gas. Those who have discussed the matter do not seem exactly to know their own minds, as one man said: "Either it is an enormous blunder backed by a number of curious coincidences, or it is a fact of first importance?"

The Late Sir Edward Frankland.—At the Chemical Society last Thursday, the Frankland Memorial Lecture was delivered by Professor H. E. Armstrong, who was for some time a pupil of this distinguished Chemist. In the course of an interesting account of Frankland's life-work, the lecturer referred to his study of water analysis and purification. In 1865 he was asked to continue Hofmann's monthly analyses of the Metropolitan Water Supply, and he continued to do this for the Registrar-General and for the Local Government Board until his death. He also investigated the question of the pollution of rivers, the purification of sewage, and domestic water supply. Professor Armstrong concluded by saying that Frankland was intensely reticent and self-contained—being ever absorbed in his own work; and he never played for place or power.

TECHNICAL RECORD.

MR. W. FOULIS ON THE ECONOMICAL PRODUCTION AND UTILIZATION OF COAL GAS.

At the Forty-fifth Session of the Institution of Engineers and Shipbuilders in Scotland, on Tuesday last, Mr. W. Foulis, the President for the year, delivered his Inaugural Address. After referring briefly to the success of the recent Engineering Congress in Glasgow, and to the necessity for the efficient education of engineers, he remarked that, following the wise example of former Presidents in dealing with subjects more or less closely connected with their special branch of engineering, he proposed to consider the question of the economical production of gas from coal and its utilization. Mr. Foulis then proceeded as follows.

It is just one hundred years since coal gas was publicly applied for the purposes of general illumination. A few years before that time, Murdoch, a millwright in New Cumnock, in Ayrshire, probably observing that the light emitted by a piece of cannel coal placed on a fire—at that time a common method of obtaining light in cottars' houses in certain districts—was due to the combustion of the smoke produced from the coal, conceived the idea of collecting that smoke and conveying it in pipes to a position where it could be burned to greater advantage. Murdoch seems to have been a born engineer, who not only observed, but, by the exercise of strong common-sense, drew deductions from his observations which he applied to practical purposes. On leaving Ayrshire, he was engaged by the firm of Boulton and Watt in erecting their steam-engines; and though his name is best known as the inventor of gas lighting, yet there can be no doubt that he was the originator of many improvements in steam-engine designing. He constructed a steam motor-car long before the locomotive engine was thought of. The D slide-valve and the oscillating steam-cylinder were among his inventions. But amid all his other work, he continued his experiments on the production of illuminating coal gas. He rose to a position of influence in the firm; and thus it came about that the first public display of illumination by gas was made at the works of Boulton and Watt, in Birmingham, in March, 1802, when the front of their building was illuminated on the occasion of the peace rejoicings then being celebrated. Since that time, the manufacture of coal gas has continuously increased, notwithstanding rival systems of lighting, until now the quantity of coal carbonized in gas-works in this country alone is not less than 14 million tons per annum; and this quantity is yearly increasing.

Dealing with the gas manufacture in Glasgow only—as accurate figures are more accessible, and they may be taken as fairly typical of the general increase—in the year ending May, 1881, the gas manufactured was 1966 million cubic feet; in 1891, this had increased to 3501 millions; in 1901, the quantity manufactured had risen to 6120 millions. To meet this large increase, additional works are almost continuously being constructed, and of increasing magnitude. Fifteen years ago, the largest gasholder in Glasgow had a capacity of 1½ million cubic feet. Since that time, several have been erected to contain over 5 million cubic feet. Two are at present being constructed, 280 feet in diameter, and 150 feet high from the ground level, or over 200 feet from the foundation of the tank, each capable of containing 8½ million cubic feet of gas. And this size of gasholder is not now considered excessive.

During the winter months, over 3000 tons of coal are carbonized in 24 hours, besides which about 2000 tons of coke have to be dealt with. When it is considered that this quantity of coal has to be carbonized in 3000 retorts charged every three hours, making altogether 24,000 charges per day, it will be evident that there is here considerable scope for the use of mechanical appliances for the manipulation of the material; and in most modern gas-works, the whole work of conveying, breaking, and charging the coal into the retorts is done by machinery. This method of carbonizing coal in small quantities necessarily entails considerable expense, even when mechanical appliances are adopted; and many suggestions have been made from time to time either for charging by a continuous process or for carbonizing coal in bulk. Considerable interest is therefore taken in the experiments which are at present being carried out on a large scale in the United States and in Canada, which have for their object the utilization of the gases produced from bye-product coke-ovens of the Otto-Hoffman type, in which the coal is carbonized in what are practically closed retorts having a capacity equal to from 6 to 7 tons of coal. I am inclined to believe that it is in this direction that future improvements in gas making will be made. An interesting paper was read at the Engineering Congress fully describing this method of gas manufacture.

The retorts in which the coal is carbonized are now generally heated by fuel gas made from the coke drawn from the retorts. The temperature of the retorts is usually about 2000° Fahr.; and efficiency in this mode of gas manufacture depends to a large extent on maintaining the temperature equally throughout the oven in which the retorts are set. An oven containing 12 retorts has a cubical capacity of nearly 1000 cubic feet. To ensure equality of temperature, it is necessary so to introduce the air and gas that combustion will take place throughout the whole

oven, ending only at the exit-flues, where the waste gases pass to the regenerator.

The necessity for maintaining a uniform temperature in the retorts will be evident if we consider that, with few exceptions, the numerous chemical compounds obtained from the distillation of coal are products of that distillation. And the quantity and character of these products depend to a large extent on the temperature to which the coal is subjected. A low temperature of distillation results in the production of a large quantity of condensable gases, forming tars, naphthas, &c.; while the volume of permanent gases is reduced. If, on the other hand, a higher temperature is employed, a different series of hydrocarbons is produced—a smaller quantity of condensable compounds and a larger volume of permanent gas.

A few years ago, cannel coal was largely used in gas manufacture; but the rapid exhaustion of the cannel coalfields, and the diminished output, have considerably altered the conditions. Gas made from oil has, to a certain extent, been substituted for that made from cannel coal; and in some works in this country, a process of gas manufacture has been introduced, which is in extensive use in the United States. Gas is produced by blowing steam through incandescent coke or anthracite in a gas-producer; and this is afterwards made illuminating by being mixed with oil gas, by a process I need not now stop to describe. This gas is technically known as carburetted water gas. The object of using oil gas is principally for the purpose of enriching the gases made from coking and splint coals. There is now, however, a very general consensus of opinion among gas engineers that such enrichment is unnecessary, or, at all events, that the candle is not worth the cost; and in the last session of Parliament, several companies and corporations obtained power to reduce the standard of illuminating power. One of the large London Companies obtained parliamentary sanction to reduce the standard quality of the gas supplied to 14 candles.

It may be interesting, in this connection, to consider for a moment the cause of luminous flames radiating light and also heat. This is now generally considered, and I think correctly, to be due to the free carbon which is liberated by the decomposition of the hydrocarbon gases by the heat of the flame. These carbon particles, being raised to the temperature of the flame, become incandescent, and continue to radiate light and heat until they are consumed by coming in contact with the oxygen of the air. They are the last component of the flame to burn; and if the supply of oxygen is insufficient, they pass off in smoke, or are deposited as soot. If the air and gas are intimately mixed before combustion, as is the case in the flame of a bunsen burner, decomposition of the hydrocarbon gases does not take place, and the flame is non-luminous—of less volume and of higher temperature. The quantity of light radiated from a flame depends very much on how the gas is burned. To obtain the maximum amount of light, the combustion must not be too rapid, so as to give sufficient time for the decomposition of the hydrocarbons to take place to the fullest extent; and at the same time combustion must be complete, to prevent the production of smoke. As each quality of gas contains a greater or less proportion of carbon, each requires to be burned under the conditions best suited to produce the maximum amount of light it is capable of yielding; and this is seldom attended to in general use. When gas is burned in this way, only about 2 per cent. of the heat energy is converted into light. The luminosity of the carbon particles rapidly increases as the temperature rises; and it was with the object of obtaining a higher illuminating result, by raising the flame temperature, that Sir W. Siemens devised, about 20 years ago, his regenerator burner, from which greatly improved results were obtained.

Many attempts have been made from time to time to utilize the higher flame temperature of the bunsen burner for producing light; but it was not until Dr. Auer von Welsbach devised the burner which is known by his name, that any practical success was obtained. In this method of producing light, the heat of the flame of a bunsen burner raises to incandescence a woven fabric or mantle, as it is termed, formed of the oxides of certain metals which have a high capacity for radiating light. By this means, it is possible to obtain six to eight times as much light from a given quantity of gas as can be got by burning it in a flat-flame burner under the best possible conditions; and the amount of light emitted is no longer dependent on the quality of the gas or on the number of carbon particles that can be separated in the flame, but only on the flame temperature.

This system of lighting was invented in 1885. The mantles were then made of zirconia, thoria, and other metallic oxides, either singly or combined. For a long time the results obtained were very irregular; and no real progress was made until, in 1893, it was discovered that, while a pure thoria mantle gave very little light, by adding to it a small quantity of ceria, not exceeding 2 per cent., the light radiation was enormously increased without in any way altering the burner or the quantity of gas consumed. If a large percentage of ceria be added, the light emitted begins to diminish. Many suggestions have been made as to the cause of this unlooked for result; but none are completely satisfactory.

The improvements that have since then been effected have been mostly confined to the bunsen burner, and to getting a more complete mixing of the air and gas. The larger the proportion of air that is mixed with the gas—up to that necessary for complete combustion—before it issues from the burner, the higher will be the flame temperature. One method of increasing the proportion of air is by increasing the pressure of the gas, and consequently its velocity as it issues from the nozzle. This increases the velocity of the induced current of air, and a larger proportion of air is drawn into the burner. This is the system which has been adopted in the gas lighting of the grounds of the Glasgow Exhibition. The pressure of the gas is increased, by means of a small water-engine, to some 8 inches of water pressure, or 0·28 lb. per inch—about four times the ordinary street-main pressure. Special pipes are, of course, necessary to convey the gas from the pressure-pumps to the lamp. There are also a number of lamps connected to the low-pressure mains, in which the increase in pressure is obtained by a simple and ingenious contrivance, actuated by the heat of the flame, and operating somewhat on the principle of a hot-air engine, but without any of its complications. By this high-pressure system, as it is called, a very great increase in the lighting power of the gas is obtained. Gas which will develop 20 candles for each 5 cubic feet consumed, or 4 candles per foot when burned under the best conditions in a flat flame, will yield a light equal to 33 candles per cubic foot, or 165 candles per 5 cubic feet, when burned in an incandescent high-pressure burner; and still higher results will no doubt yet be obtained.

The introduction of the incandescent system of gas lighting has not progressed in this country as rapidly as it has done abroad, more especially in Continental cities, in some of which about 90 per cent. of all the gas used for lighting is consumed in incandescent burners. In most of these towns, the gas is what would, in this country, be called a low-quality gas—say, 9 to 12 candles—but capable of producing light, when consumed in an incandescent burner, of nine or ten times that amount. When this method of producing light from gas becomes more extended, as it is sure to do in the next few years, it will have an important influence in altering the conditions of gas manufacture. The standard of comparison will then be the temperature which the gas-flame is capable of generating, and not what is now called its illuminating power. The result will be the manufacture of a cheaper gas, equally well suited for the production of heat and power and the purposes of illumination.

The principles involved in the economical production of gas from coal, and the utilization of that gas, have an interest for engineers generally which is yearly becoming more important. All coal must be converted into gas before it can be consumed. The quality of the gases produced, and the means adopted for their combustion, form the basis of all fuel economy, whether for the production of steam or in generating heat for any purpose; and many of the questions with which the gas engineer has to deal are just those which arise in dealing with the economical combustion of coal for other purposes. If, for example, a thin layer of bituminous coal is spread evenly over a brightly glowing fire, the first effect of the action of heat on the cold fuel is the production of hydrocarbon gases; and, just as in retort-gas manufacture, the character of these gases will depend on the temperature to which the coal is subjected. Generally, it may be assumed that the higher the temperature the more suitable will be the gas produced for after-combustion. If the coal is laid on in a thick layer, or if the temperature of the fire is too low, hydrocarbon gases of an entirely different character will be produced, containing a large proportion of condensable tarry vapours, requiring a larger volume of air for their combustion, difficult to burn under any circumstances without producing smoke; and, as they have a high ignition temperature, combustion is at once arrested on the flame coming in contact with any surface which is not considerably above a red heat—the result being the well-known emission of black smoke. There is no doubt these tar vapours escaping into the atmosphere unconsumed have much to do with the disagreeable effects we are familiar with in foggy weather.

In experimenting with gases for the purpose of testing either their illuminating or heat value, there is no point which it is of more importance to attend to than that the flame should be free to burn completely, without interference by contact with any surface, more especially if that surface is below the ignition temperature of the gas. Luminous flames are particularly sensitive to this interference. It is impossible to obtain the complete combustion of such flames in a boiler tube or among a nest of tubes set close together; and imperfect combustion means diminished fuel efficiency. About fifteen years ago, Mr. Frederick Siemens, in a number of papers read before the Royal Institution and other scientific societies on "The Best Means of Utilizing the Heat of Luminous Flames," dealt very fully with this subject. He argued that such flames should not be allowed to come into contact with any surface, however highly it may be heated; and that until the combustion was completed, the radiant heat of the flame only should be utilized, as is done to a large extent in high-crowned furnaces for steel melting, glass melting, and other purposes.

There are many questions connected with radiant heat which seem to me to deserve careful investigation. The proportion it bears to the total heat of combustion no doubt depends to a great extent on the temperature of the flame; but I have not been able to find reliable information regarding it. In some experiments made with an ordinary argand burner, the radiant heat absorbed by a quantity of water placed in an annular vessel surrounding the flame, and heated by radiation only, was equal to 50 per cent. of that absorbed by an equal quantity of water in a vessel placed immediately over the flame and heated by direct contact with the products of combustion. We know that the effect of radiant heat diminishes rapidly with the distance of the substance to be heated from the source of heat. For boiler furnaces, Mr. Siemens

proposed to place rings in the boiler-flues so as to keep the flame from contact with the plates—heating by radiation only until the combustion was complete; the heat energy in the products of combustion being afterwards absorbed in the boiler-tubes by direct contact. Whether this system of boiler heating would prove effective in all cases, I much doubt. But it is certain that, to obtain complete combustion with bituminous coal, a large combustion chamber is essential, and it is necessary to carefully consider how the radiant heat emitted by the flame can best be utilized.

When coke or anthracite is employed as fuel, the conditions produced are entirely different. The gas generated is principally carbonic oxide, which burns with a non-luminous flame. The only radiated heat is that thrown out by the glowing fuel. The combustion chamber may then with advantage be much reduced; and, as the gas produced is of more uniform quality, the air supply may be adjusted with greater certainty. To construct a furnace which will with equal efficiency consume flaming coal and anthracite or coke, seems to me almost an impossibility. The difficulty of efficiently dealing in an open-fire grate with coal which produces a large volume of hydrocarbon gases arises from the constant variation in the quality of the gases produced, varying from gases containing a large percentage of hydrocarbons requiring seven or eight times their volume of air for perfect combustion, to that of the condition of a coke-fire, the gases produced requiring only their own volume of air for their complete combustion.

The most satisfactory method of consuming coal is undoubtedly that which is more and more coming into general use. I mean the conversion of the coal into gas by its partial combustion in a separate gas-producer. The gas thus produced is of fairly uniform quality; and it is therefore possible to regulate the air supply to exactly what is required for complete combustion. A further advantage is that the air and gas can then be brought together in such a way as to produce the character of flame best suited to the purpose for which the heat is required; and on this the economical utilization of the heat of combustion largely depends. There are so many advantages to be derived from systematically converting the coal into gas outside the furnace or combustion chamber, that I have no doubt whatever that, before many years of this new century have passed, we shall have arrived at a time when a furnace burning raw coal will seldom be seen, and gas made by one or other of the methods now in operation will be the only fuel used.

Numerous suggestions have been made during the last twenty years to manufacture producer or fuel gas at central stations conveniently situated near the sources of coal supply, and to distribute the gas in pipes over wide districts. But these suggestions led to no practical result until, in the last session of Parliament, Dr. Mond obtained powers to erect works and supply gas over a large tract of country in the Midland Counties. In Mond's system of manufacturing gas, the object is not only the production of a good fuel gas from a low-class coal, but also the recovery, in the form of ammonia, of a large proportion of the nitrogen contained in the coal. Coal contains about 1·7 per cent. of nitrogen. If the whole of this could be recovered as ammonia, it would be equivalent to 180 lbs. of sulphate of ammonia per ton of coal—a quantity which would be more than sufficient to pay for the price of the coal. Not more than one-seventh of the total nitrogen is recovered as ammonia in retort-gas manufacture. About twenty years ago, Professor Foster, in a paper read to the Institution of Civil Engineers, stated, as the results of his experiments, that one-half of the remainder was left in the coke; and about the same time Mr. Beilby devised a method of recovering, in the form of ammonia, a considerable proportion of the nitrogen contained in the coke produced in shale-oil retorts, by blowing steam and air through it while incandescent—a process which has been of great financial benefit to the Scotch shale-oil companies. It is this process which Dr. Mond employs. He blows into the producer, along with the air, a large volume of steam, equal to about 2½ tons per ton of coal; the result being that he obtains ammonia equivalent to about 90 lbs. of sulphate per ton of coal used. The value of this, at £10 per ton, is 8s. Deducting the cost of manufacturing the sulphate, there remains a profit of about 4s. 6d. per ton of coal. As it is proposed to use cheap slack, or dross, a large percentage of the cost of the coal will thus be secured. In order to recover the ammonia, it is necessary to cool the gas to atmospheric temperature. This is also necessary when the gas is made for use in gas-engines without the ammonia-recovery process; and one important feature of the Mond gas plant is that the heat abstracted from the gas during the cooling process is returned to the producer.

The gas produced, which has a heat value of one-fourth to one-fifth of that of retort coal gas, it is proposed to distribute throughout the district in pipes. There is no difficulty in thus distributing gas over many miles. Gas is being daily sent to points ten or fifteen miles from the source of production, under low pressure, and with little loss. The only difference in dealing with producer gas is that four to five times the volume of gas requires to be sent through the pipes to produce the equivalent heat energy, necessitating either larger mains or higher pressures. It is proposed to sell this gas at 2d. per 1000 cubic feet when taken in quantity. Whether or not this will be sufficient to meet all the cost of manufacture and distribution, has to be proved; and the development of the scheme will be watched with much interest.

There is perhaps no subject of more rapidly increasing interest to engineers than that of the utilization of gas for the direct production of power by its combustion in gas-engine cylinders. The direct conversion of heat into power by internal combustion, instead of first transferring the heat to steam, has occupied the attention of many minds during the last hundred years; but it is only within the last twenty-three years that it can be said to have come into practical use. It was in 1878 that the "Otto" gas-engine was first publicly exhibited at the Paris Exhibition of that year. Since that time, the progress in this means of power production has been far beyond what could have been anticipated. In 1899, Mr. Bryan Donkin estimated that there were then 50,000 "Otto" gas-engines at work; and this number must now be largely exceeded. From information I have been able to gather, the number of gas-engines manufactured in this country alone cannot be less than between 6000 and 7000 per annum.

But it is not only in the number of engines sold that progress has been made; there has also been a great development in their efficiency. Twenty years ago, very few gas-engines used less than 30 cubic feet of town gas per brake-horse-power; the thermal efficiency obtained being about 12 per cent. By improvements since effected, the consumption has been gradually reduced to 13 cubic feet per indicated horse power, and 15 cubic feet per brake horse power, and the thermal efficiency increased to 25 per cent.; and in tests made on recently constructed engines, consumptions as low as 13·4 cubic feet per brake horse power are said to have been obtained, the heat efficiency being 29 per cent. When using producer gas, the consumption of coal has been reduced to 1 lb. per indicated horse power. The capacity of the engines has also greatly increased; several makers in this country are now manufacturing engines capable of developing 500-horse power and upwards. Engines of 1000-horse power and upwards are at work in other countries; and I understand that some of from 2000 to 3000 horse power are being designed, if their construction has not already been begun.

The immediate demand for these large power gas-engines is for the purpose of utilizing the gases from blast-furnaces, at present being practically wasted. The first application of blast-furnace gases for the production of power in gas-engines was a 30-horse power engine erected at the Wishaw Iron-Works in 1894. At that time, engines of much larger size were still in what might be called the experimental stage; but it is evident that the great volume of gas produced in a blast-furnace can only be dealt with successfully in engines of large size. The economy to be obtained by the use of gas-engines for this purpose has up till now been more fully appreciated on the Continent than in this country; but there can be no doubt that the utilization in gas-engines of the waste gases from blast-furnaces, coking-ovens, &c., opens up a wide field for the economical production of power. It has been estimated that the surplus gas from a blast-furnace—that is, after deducting what is required for the hot-blast stove, and providing, by means of gas-engines, the power required for the blowing engine, pumps, hoists, &c.—would be sufficient to develop 20-horse power for every ton of iron produced per day.

The President of the Iron and Steel Institute, in his address to the Society last May, estimated that the surplus gases from blast-furnaces, at present practically being wasted, would, if consumed in gas-engines, develop 1900-horse power per 100 tons of iron made per day; and he proceeded to say: "If, to be on the safe side, we take the reduced estimate of 1000-horse power as the surplus, we get a wonderful result when taken over such a district as Cleveland. The make per day approximates 6100 tons. At 1000-horse power per 100 tons, we have a surplus of 61,000-horse power, equal to the consumption of over half-a-million tons of coal per year." Applying these figures to the whole iron production of this country, we get 240,000-horse power as the total which may be obtained from this source.

Another source of power production which may be utilized is the surplus gas from recovery coke-ovens. In a paper read at the Engineering Congress, to which I have already referred, the amount of this surplus gas is stated to be 4000 cubic feet per ton of coal; the gas having a heating value of over 600 British thermal units. According to figures given by Mr. Beilby, in his address two years ago to the Society of Chemical Industry, the total amount of coal converted into coke in this country is 13 million tons. Only about 1¼ million tons is at present made in recovery ovens. The surplus from this would be sufficient to produce 35,000-horse power; but if the whole of the coke was made in recovery ovens (which it might be with economy), the surplus gas at present being wasted would develop 370,000-horse power.

We have therefore from these two sources a quantity of gas at present being wasted capable of developing, if used in gas-engines, 600,000-horse power applied continuously throughout the year. In Germany and other Continental countries, considerable progress has already been made in utilizing these waste gases. We have not made much advance in this direction; but the subject is well worthy of the attention of engineers in this country. One difficulty of utilizing these waste gases to their full extent is that the production of gas is constant, while the power required is likely to be intermittent; therefore, some means of storing the gas or energy in some form might be necessary. Electrical storage batteries are not yet sufficiently developed to be of much practical use for this purpose. With gases from bye-product recovery coke-ovens, there would be no more difficulty in storing the gas than there is in storing the gas made in retorts, as both have about the same heat value. With blast-furnace gases, the difficulty arises from the large amount of gas that has to be dealt with. Ten thousand-horse power require about 1,300,000 cubic

feet of blast-furnace gas per hour. It might probably be sufficient to provide storage for six hours' consumption, or 7,800,000 cubic feet. A gasholder to contain this quantity of gas would not be of excessive dimensions, and could be erected for a capital expenditure of about £8 per horse power. Whether this expenditure would be profitable, would probably depend on local conditions; but I have no doubt some means would be devised to overcome this difficulty. The immediate question which engineers have to consider, is the development of the gas-engine, to enable it to deal with this large volume of gas.

The majority of gas-engines at present at work use town gas, and with considerable economy, for engines of moderate size. Assuming that 1 brake horse power may be obtained from the consumption of 15 cubic feet of gas—at the price of 2s. 2d. per 1000 cubic feet, which may be taken as the rate at which it is sold in Glasgow when coal is at normal price—the cost per brake-horse-power-hour would be 0·39d., equivalent to £4·4 per annum; the engine working 54 hours per week for 50 weeks. And it is to be remembered that there are no stand-by losses, no firemen's wages, nor cost of removal of ashes; and that the power may be sub-divided and the engine placed near where it is required.

The area supplied from the Glasgow Gas-Works is about 15 miles long by 8 miles broad—or (say) 120 square miles; and over practically the whole of this area power may be had at the above rate. We have here a method of power distribution which will compare favourably with other systems that have been proposed. Within this area there are now at work engines using town gas of an aggregate capacity of about 9000-horse power; and the number of engines is rapidly increasing, and of increasing dimensions.

It may be of interest to note that 15 cubic feet of gas are produced from 3½ lbs. of coal of average quality; and in addition to the gas, there remains for sale from 8 to 9 cwt. of coke per ton of coal used, besides tar, ammonia, &c. The whole of the tar produced may be used as fuel. But its true value lies in the number of chemical compounds that may be derived from it; and only a portion of the pitch obtained from it by distillation is used as fuel—mixed with coal in the form of briquettes. It would be difficult to obtain an accurate estimate of how much is used in this way; but I think we may safely estimate that, using town gas, a brake horse power may be obtained from a net fuel expenditure of not more than 1¾ lbs. of coal per hour, leaving out of consideration the money value of the ammonia and the chemical compounds derived from the tar.

From 70 to 80 cubic feet of producer gas are required per horse power per hour; and this amount is obtained from 1 lb. of coal. With Mond producer gas, it is stated that 60 cubic feet are sufficient to develop 1 indicated horse power per hour, and that this quantity of gas is produced from each 1·03 lbs. of cheap slack put into the producer. It should be remembered that the gas-engines hitherto erected have been in nearly all cases in substitution for steam-engines of moderate power. If compared with such engines, these figures show that a very substantial economy in coal consumption is obtained from the employment of gas-engines.

The consideration of most interest to engineers in connection with the gas-engine is the possibilities it possesses for further improvement. As at present constructed, about 30 per cent. of the heat generated in the cylinder is lost in the water-jacket, and about 40 per cent. is carried off in the exhaust gases. Some means of keeping the cylinders cool will always be necessary; and therefore it is perhaps too much to expect that any very great saving will be effected in the first item. But a considerable proportion, if not the whole, of the heat at present lost in the exhaust may—and I have no doubt will before long—be prevented or recovered in useful work.

The disadvantages of the "Otto" cycle, when applied to large gas-engines, are the heavy strains thrown on the working parts by the high initial pressure, as compared with the mean working pressure in the cylinder, and also that only every fourth stroke of the piston is a working stroke. I am very strongly of opinion that, for large gas-engines, a type in which the expansion due to heat takes place at constant pressure, instead of constant volume, will come to be adopted. Some years ago, I made a long series of experiments with an engine working on this principle which I designed. This engine developed about 5-horse power. The results obtained were very encouraging; but unfortunately my other duties prevented me devoting to it the time necessary to ensure complete success. An engine acting on this principle has a working stroke every revolution. The ratio of the initial pressure to the mean working pressure is less than in the "Otto" engine. I found that the complete combustion of the gas could be more easily ensured, and was more under control; and a further important advantage of this type of engine is that it would then be possible to utilize the heat of the exhaust gases in a regenerator in a similar manner to the regeneration in a hot-air engine.

The gas-engine has made great advances during the last twenty years. I am convinced that still greater improvements will be made during the next twenty years; and while we may not agree with Sir Frederick Bramwell, who, twenty years ago, prophesied that in fifty years steam-engines would only be found in museums, and that heat would be converted into power in gas-engines only, there can be no doubt that, for stationary land engines, the gas-engine will come more into use, supplanting steam-engines and resulting in a great economy of fuel and a purer atmosphere.

Mr. Foulis concluded by congratulating the Institution on the progress they had made, and urging upon the members the need for their hearty co-operation.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting in Boston.

The members of the above-named Association held their twenty-ninth annual meeting in Boston (Mass.) on the 16th and 17th ult., under the presidency of Mr. Edward G. Pratt, of Des Moines (Iowa). We learn from the "American Gaslight Journal" that the attendance was numerous and representative. The first business was the presentation of the report of the Council, which set forth that 48 names had been proposed for placing on the list of members, and 25 for the associate division; while 3 transferences from the latter to the former were proposed. The Council also recommended the election as honorary members of Dr. H. Bunte and Herr W. von Oechelhaeuser, both of whom are universally known for their services to the gas industry. The report of the Council having been unanimously adopted, those of the Secretary and Treasurer (Mr. A. E. Forstall, of Montclair) were submitted. While they showed that good progress had been made by the Association, they bore the record of eight removals by death. The report of the Education Committee was next considered, and ordered to be received and filed. This routine business having been disposed of, the President proceeded to read his Inaugural Address, which was longer than the usual run of addresses on the other side of the Atlantic. Mr. Pratt is a firm believer in the present and future of the gas industry; and his interesting address held the attention of the members until the end. It was, as usual, referred to a Committee for consideration and report. The next business was the nomination of office-bearers; the result being as follows:—

President.—Mr. William R. Beal, New York.
First Vice-President.—Mr. Alten S. Miller, New York.
Second Vice-President.—Mr. Rollin Norris, Philadelphia.
Third Vice-President.—Mr. E. G. Cowdery, Milwaukee.
Secretary and Treasurer.—Mr. A. E. Forstall, Montclair.

Mr. Beal having returned thanks for his election, Mr. A. C. Humphreys read the report of the Committee appointed last year to deal with the proposal to secure uniformity in the accounts of gas companies. The Committee was re-appointed; and this brought the morning sitting to a close. The first business in the afternoon was a verbal report by Mr. Alten S. Miller on behalf of the Committee on Research, who were thanked for their work, and requested to continue it. The reading of papers was then commenced. The first bore the title: "What is the Business of a Gas Company?" the author being Mr. Frank D. Moses, of Trenton (N.J.); and it led to a good discussion. The next contribution, which was of a more technical character, was by Mr. W. E. M'Kay, who took for his subject "Tar and Water from Water Gas." A query from the "Question-box" was then dealt with, and the business of the first day ended.

The following morning, the proceedings opened with an invitation to the members to visit the plant of the New England Coke and Gas Company at Everett, which was accepted. The appointment of the Committee to award the Beal Medal was announced, and that on Final Resolutions nominated. After this, Mr. E. H. Earnshaw, of Philadelphia, read a paper entitled "Further Notes on Retort-House Practice," which showed good practical knowledge of this branch of gas manufacture. A few miscellaneous matters filled up the interval till the time came for adjournment for luncheon. In the afternoon, the opening subject for discussion was furnished by the "Question-box," after which came a paper by Mr. T. Littlehales, of Syracuse, on "Retort-Ovens as Producers of Illuminating Gas." He treated the topic in an entirely unconventional way, and was thoroughly successful. A useful and interesting discussion ensued. The next paper considered was one by Mr. Charles F. Prichard, of Lynn (Mass.), who put together a clear statement regarding "The Fuel Value of Residuals." This proved to be the last paper read; for, owing to his inability to be present at the meeting, the communication by Mr. Paul Doty, of Detroit, on "The Analysis of Gas Accounts," was withdrawn. Mr. Walton Forstall, of Philadelphia, next presented a short topic, on a comparison of standards for cast-iron pipes and specials as between those recommended by the Association and those adopted in the practice of the United Gas Improvement Company. The Question-box was then exhausted, the usual votes of thanks were passed, and the technical portion of the meeting came to an end. In the evening, the usual banquet took place, and next day an excursion to Lexington and Concord.

Now that a great deal of attention is being given to the subject of aërial navigation, it may not be without interest to call attention to a note by M. Ch. Lambert, in a recent number of the "Revue Technique," in which he points out that the gas ordinarily used for inflating balloons is always more or less saturated with moisture. He shows that a balloon having a cubical capacity of 35,000 feet, would, when full of gas, carry with it the useless, and even injurious, weight of 37 lbs. of water if the temperature were 68° Fahr. at the filling-place. Apart from this weight, the presence of sulphurous acid and water, or even of hydro-sulphuric acid, in ordinary illuminating gas might induce the formation of sulphuric acid, and cause a rapid destruction of the material of the balloon. The author advises the cooling and thorough purification of the gas by one of the "cold" processes now known in commerce.

GAS-ENGINE RESEARCH.

A Special Meeting of the Institution of Mechanical Engineers was held last Friday, for the purpose of continuing the discussion on the second report of the Gas-Engine Research Committee, as presented by Professor F. W. BURSTALL, of the Birmingham University. Extracts and tabular statements from the report, with the first part of the discussion, were published in the "JOURNAL" a fortnight since.

The PRESIDENT (Mr. William H. Maw) made the preliminary announcement that Mr. H. A. Humphry and Mr. Dugald Clerk had been elected members of the Research Committee; and he was confident they would add considerably to its strength.

Professor CALLENDAR resumed the discussion; his remarks (which were very extensive) being directed mainly to the consideration of the question of the measurement of temperatures. He commenced by expressing his appreciation of the work done by the Committee, and particularly of that of Professor Burstall, during the last five years, on the measurement of temperatures in a gas-engine. The report positively bristled with controversial points. Looking at it superficially, it struck him that the important point which they were here studying for the first time, perhaps with success, was the effect of the walls of the cylinders of the gas-engine on the cycle which was taking place inside. They were able to see how the cooling effect of the walls modified the elementary theory of the engine; and they were able to form some estimate as to how far the temperatures inside, which could be calculated from the observed pressure of the gas with the indicator—as to how far these calculated temperatures really agreed with the true temperatures, and how far the temperatures varied at different points of the engine. This was really a very difficult point; and it was a difficulty similarly in the theory of the steam-engine. The condensation of the steam on the walls of the engine had always been one of the great difficulties in steam-engines; and several of them had tried to get, and to formulate, some rational theory concerning it. One point in the report (near the beginning) struck him as bringing forward this difficulty in a prominent manner. It would be noticed, and he thought for the first time—in an English paper at any rate—some of the results had been calculated, allowing for the variation of the specific heat of the gases in the cylinder owing to the results of the explosion. Now the method by which these average specific heats of the gaseous mixture were calculated was simple and ingenious; and the experiments by MM. Mallard and Le Chatelier were of the highest importance. But they were extremely doubtful. It was impossible to say how far the cooling effect of the walls of the cylinder modified the real temperature of the gas; and it was very possible in these experiments that the correction for the cooling effect was not carefully applied, though the authors attempted to do so in the best way in their experiments. However, he thought perhaps the specific heats obtained were a great deal too large. The specific heat, for instance, of carbon dioxide was very nearly three times as great at 2000° as it was by measurement at ordinary temperatures. The temperatures were very possibly under-estimated, owing to not allowing sufficiently for the cooling effect. Of course, said Professor Callendar, these were difficult experiments; and, in his subsequent remarks, he endeavoured to make his hearers realize the difficulty by an explanation in connection with an experiment in which the explosive mixture used consisted of hydrogen and oxygen in their combining proportions. He did this to give some idea of the difficulty of placing implicit reliance on the value of the specific heats obtained in the manner adopted by the two investigators named. He thought perhaps the formulæ were really very doubtful; but, as the reporter said, they were at any rate the best that were to be had at the present time. However, they were made a long time ago; and it was, in his (Professor Callendar's) opinion, rather desirable they should be repeated. Proceeding, he said that he would confine his remarks chiefly to the question of the measurement of temperature, of which he had had more experience than of the actual testing of gas-engines. It might be in the knowledge of some of the members that he made a number of experiments closely analogous to those which had been carried out on the gas-engine by delicate thermometers, the results of which were given to the Institution of Civil Engineers a few years ago. The experiments were undertaken in 1895 at the same time as Professor Burstall's first experiments on the gas-engine; but his own were on the steam-engine. One of the most obvious differences in the experiments was in the construction of the thermometer used for measuring the temperature of the steam. The thermometer was attached to the piston of the steam-engine, and worked backwards and forwards through the steam for about a month. So long as it was inside the cylinder where the workmen could not get at it, it survived all right. It would stand the steam being turned straight on to it, and the knocking about of the steam did not tend even to break the fine wire; but when he used it on the outside of the engine in a tube, to get the temperature of another part of the cylinder, it soon got broken. He indicated the construction of the thermometer he used, and then described the various differences which occurred between his own methods and those of Professor Burstall—pointing out that there were several difficulties absent in the steam-engine which occurred in the gas-engine. In the latter, the temperatures to be measured were much higher; and this made it necessary to employ a stronger wire. The explosion was more violent than any amount of steam. He (Professor Callendar) was able to use a wire $\frac{1}{1000\text{th}}$ of an inch diameter; while Professor Burstall was only able to use one of $\frac{1\frac{1}{2}}{1000\text{ths}}$ or $\frac{2}{1000\text{ths}}$ of an inch. Another danger in the case of gas-engines was that the platinum wire might get damaged by carbon, which might possibly make it rather more fusible, so that it would give way more easily. In thermometers of this kind, the most important condition to satisfy was that of great sensitiveness. The thermometer must work extremely quickly, so as to be able to measure the temperature to advantage. This was even more important in the case of a gas-engine where they had so high a speed. In the steam-engine, he did not use a speed of more than 100 revolutions, while in the case of the gas-engine, Professor Burstall used 120 revolutions, and might have succeeded in getting measurements at even higher speeds than that. There was thus a very short time in which to measure the temperature, so that it was important to use an exceedingly fine wire—the finer the better. A suggestion had been made that strip should be employed, instead of wire, on the ground that it was so much quicker than wire; but it gave so large a surface to the rapid currents of the gas that he was afraid that it would possibly get twisted, and so become useless. There was no doubt, from his own and Professor Burstall's experiments, that the fine wire was quite quick enough, and that they could get reliable measurements of temperatures—the wire lagged but very little behind the temperature of the steam or the exploded gases. But another important question was whether the wire ever reached the actual temperature of the exploded gas, owing to the error of radiation. The wire was being heated by the gas; but it was all the time losing heat by radiation to the sides. So, apart from all question of quickness, the wire would never reach the actual temperature of the gas—it must always be cooler than the gas. It was an important question how great was this radiation error—in other words, how much hotter was the gas than the wire on account of this loss by radiation. The wire would only reach a stationary temperature when the loss of heat by radiation was equal to the gain of heat by conduction or convection. It was important, in taking out these high temperatures in gas-engines, to make sure that the radiation loss was not too large compared with the conduction co-efficient. Professor Callendar, by the aid of the blackboard, dealt with this point at some length. Then proceeding, he said that in the case of the gas-engine, the difficulty was greatly increased because they were not able to use very fine wires, as they became fused by accidental or local high temperatures in the explosion. This was a point that Professor Burstall had brought out very clearly in the report, that the temperatures which occurred in these explosions in the gas-engine were really very much higher than the temperatures calculated from the average pressure of the whole gas. They would naturally conclude they were much higher, because it was possible to fuse fine platinum in the cylinder of the gas-engine. It was a fact that they could fuse fine platinum wire in almost any gas-flame most easily, provided the wire was fine enough. A wire $\frac{2}{1000}$ths of an inch diameter could be fused fairly easily; and one of $\frac{1}{1000}$th of an inch would fuse almost instantaneously. This showed that the temperature was above the melting-point; and that temperatures above 1800° C. occurred in the working of a gas-engine was proved by Professor Burstall. At some length, Professor Callendar set himself to show that the temperatures were much higher than Professor Burstall had led them to suppose; and this, he said, could be illustrated by using two wires—a thin and a thick—in a flame. It would be found that the thin one got much hotter than the thick one. He then criticized the suggestion of one of the speakers at the previous meeting as to the use of the thermo-couple, pointing out its disadvantages, and giving as its real use the determination of the actual temperatures of the walls of the cylinder of a gas-engine, and the amount of heat which was absorbed by them. If, he said, they could calculate the heat absorbed in this way, they would be able to work out the heat balances very much more satisfactorily.

Professor D. S. CAPPER (King's College, London) said the results of the report impressed one as being a real step forward in their knowledge of the gas-engine. One point which Professor Burstall had satisfactorily explained was that which, in most gas-engine trials, one had, through default of no adequate explanation, always treated as after-burning. He did not suppose there was anyone who had used the expression "after-burning" without having qualms of conscience in doing so, because few really believed that after-burning really took place. Professor Burstall hinted at the explanation when he said that they had a varying instead of a constant specific heat during the process of expansion. Taking, as an example, a trial of his own published some years ago, in which the exhaust analyses were used for the calculations, he said that he found there was an over-balance (which appeared to be after-burning) of something like 5 per cent. He had taken the trouble since to work out what would be the result if only he had taken into account the specific heat; and he found that the whole of it disappeared—in fact, he got a balance on the other side. This, to his mind, was, after all, from the common-sense point of view, almost certainly the true explanation. Like Professor Kennedy, he wished Professor Burstall had given them the results in English as well as in metric units. He thought the results would not have full weight in this country, simply through the

trouble of comparing them with the results already published. With regard to the effect of compression on economy, it did not seem to him that Professor Burstall had conclusively proved that compression did necessarily increase the efficiency of the engine under similar conditions. It appeared to him there was something more they wanted to know before they could really state that compression did always increase the efficiency. He thought the point made by Professor Burstall, as to the fact that they only used about one-third of the total range of temperature in a gas-engine, was really the one upon which effort was to be more largely exerted. In that direction, in his opinion, lay the possibility of increasing the efficiency of a gas-engine; and that this would be done was, to his mind, an absolute certainty.

Mr. Arthur Rigg next explained the construction and working of an indicator made as far back as 1859, to take a diagram every 1000 revolutions of an engine.

Mr. E. R. Dolby (London) asked for information as to the method adopted in measuring the temperatures; but he was directed to the paper for particulars.

Mr. Goodchild (Derby) said that the points in the stroke at which the exhaust-valve opened in the Otto-cycle engine made a great difference. In his own case, he had found it possible to increase the power of an engine by opening the exhaust-valve one-tenth earlier in the stroke. Then, as to the great variation in the mechanical efficiency of the engine, as shown in the report, it seemed to him that a larger engine more in accordance with present-day practice, with a direct-coupled dynamo of known efficiency, would give quite as reliable results as a rope brake. The tests given in Appendix VII. did not, to his mind, show anything with reference to compression and the thermal efficiency. No doubt, from the research point of view, the table was very correct; but from a practical point of view, what they wanted to get was the greatest amount of power for the best economy. In these tests the engine was only working at about half-load; and for the size of the cylinder, the maximum power was not being got out of the engine that was possible. To confirm this, he would suggest that a comparison should be made between the tests quoted in Appendix VII. and some of the other diagrams which gave greater temperature ranges. For instance, in experiment A 7, the temperature range in the cylinder was 288°, and the brake horse power was 2·72. With the same comparison in A 4, the brake horse power was 3·55. It stood to reason, if the engine was coupled to do 3·55 brake horse power, that would be its nominal load—it would be used as an engine of that horse power rather than one of a lower horse power. The temperature in that case was 447°; and the thermal efficiency was slightly less. In A 4, too, the cubic feet of gas per brake horse power was 30·9; while in the case quoted in Appendix VII. it was 34·9, though a better thermal efficiency was being obtained in the case of the former. It was only 0·2; but they were spending 4 cubic feet more gas per brake horse power, and that was the commercial side of the question. Then, again, on referring to A4 and A7 experiments, it would be found that the compression pressure was 3·98 kilogrammes per square centimetre and 4·32 kilogrammes respectively. It was concluded that the extra 0·2 of thermal efficiency was due to this compression. But the tables were not comparable on the same basis. Take B3 and B9 (which was the test quoted in Appendix VII.), the temperature range was 645 and 351. There again the number of cubic feet was 28·2 per brake horse power, against 33·5, so there was a giving away of 5·3 cubic feet just for the sake of having under an extra 2 per cent. of thermal efficiency. Then if they took the minimum gas consumption per brake horse power, for the A compression the thermal efficiency was 18·7; for the B compression it was 19·4; for the C compression it was 20; for the D compression it was 22·7—a gradual rise in thermal efficiency with compression. The tables also showed that, within certain limits, moderately rich charges at lower compressions were quite as economical as higher compressions with very weak charges. Under the B compression, they had a thermal efficiency on the brake horse power of 16·68; and under the D compression, of 16·34. It was actually less on the higher compression—that was, taking the thermal efficiency on the brake horse power, and not the indicated horse power. The thermal efficiency rose in proportion to the compression to a certain extent, but it was not strictly proportional. There was one point in favour of moderate compression—not only was there less tendency to pre-ignition, but, with a moderate compression, the engine did not cost so much, it did not need to be so heavy, nor so strong. He should like to ask whether the compression was altered by junk-rings, or packing pieces on the crank-end. [Professor Burstall: Both.] If they put a junk-ring on the back end of the piston, they did not know to what extent they were altering the radiating surface. Unless the cooling surface of the front end of the cylinder was a constant quantity, if a plate was put on the back, they would alter the amount of radiation on that end. With reference to the construction of the engine, in the first report, he noticed the air-inlet was adjacent to the exhaust-outlet. In these days, he did not think there was any engine of standing where they were adjacent; the object being to keep the air-inlet as cool as possible, even to the extent of putting it on the opposite side of the cylinder. This adjacency might account for the suction temperatures shown in these experiments. He took it that Birmingham gas was used; and he believed it was a fact that there a lot of carburetted water gas was mixed with the ordinary coal gas, and this would account for the low calorific value of the gas—about 550 units, while he believed 640 units was about the figure for ordinary lighting gas. He should like to know whether it was not possible to work with producer gas, and the temperature range be better utilized. With producer gas, the temperature was naturally lower to start with than coal gas. The exhaust temperature was less also; and the range of temperature utilized would be better than with town or lighting gas. Were, he asked, any experiments going to be made on producer gas, and cycles other than the Otto.

Mr. W. Worby Beaumont (London), while agreeing that the report supplied a large amount of information, said he could not help admitting that a large part of what the last speaker had said was deserving of a remark of confirmation. It was a pity that the experiments had not been made on an engine, if not of more modern design, at all events working under modern conditions, and (with all due respect to those who had been making the experiments) worked by those who could get the best results from the engine, because however careful the results of the working of the engine were taken as shown by the experiments, however careful they might have been observed, however careful the composition of the products of combustion might have been taken, and all the other difficulties tackled, the whole of the results depended for their value upon the way in which the engine as a tool, using certain materials for its operation, had been used. The reporter had given them a tremendous lot of materials; but he had not done much for them in the way of drawing conclusions. The materials in a sense were very valuable; but there were numerous points in connection with gas-engine economy which made him say that he wished a newer engine had been employed, and possibly worked by those who made engines. To begin with, the author said: "Some of the heat energy however does pass out, being converted into kinetic energy of the exhaust. To estimate this amount the charge in the clearance space has been supposed to expand adiabatically from exhaust pressure to the pressure of atmosphere; the change of internal energy due to this expansion has been taken as the heat lost by the residue to exhaust." It was admitted that there was a mere nothing resulting from this. But it came to this, that the results were only valuable when they were taken with regard to an engine constructed particularly as this was; for that statement did not include any differences as to the energy which might come about through one of the points mentioned by the last speaker—viz., not simply the relative positions of the air and exhaust valves, but the sufficiency of the air and exhaust valve space for the different conditions especially if the engine was running at any speed at all. Then the amount of the energy so absorbed might vary. The reporter told them also that the loss to the jacket was much larger in Dr. Slaby's experiments than in his own, and that modern gas-engines owed their improved efficiency mainly to reduced wall loss. But the reporter left them to go through the tables and diagrams to see how it was that the improved efficiency which was obtained by this reduced wall loss came as a result of that. How did the reduced wall loss come about now as compared with an engine of some time since? As the reporter did not tell them this, and as it was difficult to gather from the figures that this was the case, it appeared that a further statement of his with regard to compression was open very much to question, when he said in effect that the gain due to compression was not so much as was commonly supposed. Professor Burstall went on to say that for many reasons very high compressions were not desirable, and he drew attention to the fact that "at present gas-engines are only utilizing about one-third of their total temperature range, when working under best conditions, while in steam-engines more than three-quarters of the temperature range is utilized." Having shown that in his view this comparison was a very misleading one, the speaker said that in the engine with which the experiments had all been made the speed had been the same throughout, and the compression had been varied without variation (for a given compression) in the strength of the mixture. He would like to suggest that, if Professor Burstall intended to continue these experiments, one of the most important things to enter upon would be the effect of much higher speeds. Higher speeds with higher compressions and higher pressures were necessary to get some real practical notion of the value not only of these high pressures, but of the high temperatures and high compressions. It was on points like these that they needed information in order to get the full values from the figures the reporter had given them; they wanted certain other experiments which would be carried out on the lines of the modern tendency with regard to gas-engines. The engine that was using, even with the poor gas employed, about 30 cubic feet per brake-horse-power, must be doing either very badly or be working under bad conditions. He hoped that in some way or other figures would be obtained that would be valuable to those who were to take steps in the construction of gas-engines beyond the point that had already been reached. He wished to remark that he would be the last to say anything in the least disrespectful of the way in which the engine had been used for experimental purposes; but when new experiments were made, or if these were to be continued, he would like to suggest that they did not very much want to see what could be obtained when a gas-engine was run so as to show how badly it could work.

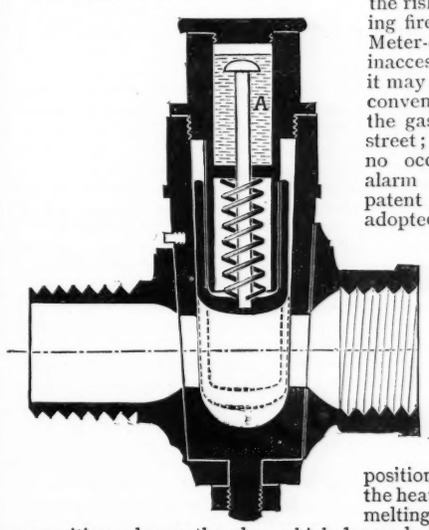
Professor Burstall, replying upon the discussion, said Mr. Beaumont commenced by telling him that he did not know how to run a gas-engine. Exactly where he derived that information, he (Professor Burstall) did not know. He did not think that Mr. Beaumont had ever seen him run a gas-engine; and it was rather

a gratuitous assumption on his part that they did not know how to run gas-engines quite as well as the makers, who not infrequently asked them to run engines to their best efficiency. He (Professor Burstall) knew better than anybody that this engine was not the best one that could have been used for the purpose of the research; but he should like to point out that it was the only engine that could be used for the purpose. Certain of the gas-engine makers of this country were approached and asked to either lend or sell an engine for the purpose, and they declined. The Committee had therefore to take the best engine they could get; and the remarks that had been made, that this engine was not modern practice or anything else, were quite beside the question—either the experiments had to be made on this engine, or not at all. In the future, the experiments would be made on an engine of the most modern class, and of 150-horse power; but this could only be done because at the present moment, through the generosity of an American citizen, the Birmingham University was able to spend a large sum of money on its engineering department. As to the criticism of the metric units, he might explain that they arose in this way. The engine was partially graduated on the metric system, and the instruments were partially graduated on the metric system and partially on the English system. He naturally wished to work the figures out in both units; but his staff absolutely refused to work them in English units. They said there was quite bother enough getting them out in the metric. In fact, it was impossible to work out complicated mathematical expressions in the English system without running an enormous risk of errors. He hoped English engineers would endeavour to work more and more on what was a very simple system of units. He was certainly not aware of the interesting point that had been raised by Professor Callendar with regard to the relative loss between radiation and conduction. He had considered that conduction was enormously greater than radiation; but he could quite see it was possible that conduction losses, being as the fifth power, would be a serious matter at the temperatures at which he had worked. In no part of the paper did he say that the temperatures were right. They were not the temperatures. He was quite aware the thermometers were lagging during the whole time; and the temperatures were not noted until one-tenth of the stroke had been completed. The initial temperatures were so very far behind that they were absolutely low. He looked upon it that the wires were following the temperature. He had tried to determine the lag, but without success. It was possible that Professor Callendar's suggestion, as to connecting the two wires, would be utilized. Mr. Goodchild had spoken about the valve setting. That was kept constant. The exhaust-valve opened at 95 per cent. of the stroke. The mechanical efficiency of the engine was variable; but he did not trouble much about the mechanical efficiency. It was not, from the research point of view, of great importance; and, as regards these experiments, they were conducted on research lines purely. They served as a sort of opening up for experiments on a large scale; and therefore he did not particularly trouble about mechanical efficiency. Mr. Goodchild would doubtless be pleased to know that the new engine would be coupled direct to a dynamo, and the load would be thrown on by artificial resistance. In the past experiments, alterations in compression were partially done by packing pieces and partially by junk-rings. The junk-ring was not a desirable method, but it was the only way it could be done at the particular time. The temperature measurements were made on an engine without a junk-ring, so that there was no cooling action on the wall introduced by the junk-ring in the temperature experiments. With regard to the inlet-valve, he was not with Mr. Goodchild. He (Professor Burstall) was going to put the inlet-valve quite close to the exhaust-valve in his new engine; and he did not see any special objection, unless Mr. Goodchild referred to the scavenging, which would be done by other means. The low value of the coal gas was due to the authorities at Birmingham; and so that was quite beyond his control. As to coal *v.* producer gas in large engines, one would never dream of using coal gas. He hoped everybody who used gas-engines in the future would not think of employing coal gas, but would simply think of using producer gas as a matter of course. It was not intended to conduct experiments on any cycle other than the Otto. That was the only one of any importance whatever. With regard to the table that had been objected to, it was merely put in to assist members in comparing the efficiency of the engine at different compressions. Of course, the efficiency would vary according to the compression and according to the ratio of air to gas. He did not think this, or any other, table showed conclusively that the efficiency rose rapidly, or even to a small extent, with the compression; and he put it in just as an assistance, and had not drawn any conclusions from it, for very obvious reasons. One did not wish to do this at present, recognizing that these conclusions could only be drawn with a bigger plant. The variability of the specific heat which had been alluded to by Professor Callendar was, of course, a most important point. He (Professor Burstall) quite agreed with him that the results were not at all accurate. He had, however, to use some figures; and therefore, he took the best he could obtain. He trusted at some future date to repeat the experiments on the variability of the specific heats with the Callendar thermometer, and in this way to eliminate the cooling action of the wall. He confessed that he did not see why Mr. Beaumont objected to him stating that the gas-engine as a thermo-dynamic machine was bad, and that it did not utilize its range. It threw its exhaust products out at a fairly red heat; whereas the steam-engine threw its products out at about 100° Fahr. The amount of energy which was utilized in a gas-engine was large simply because of the high temperature; but looking at it as a machine for turning heat into work, it was not doing as well in its own way as a steam-engine was doing in its way. If it were, there would be no steam-engines whatever. But, as a matter of fact, they had steam-engines running at a cost consumption very little worse than that of the best gas-engine. The steam-engine had a thermal efficiency of about 18 or 19 per cent., and they could get 36 per cent. out of the gas-engine; so that he did not think the gas-engine had reached the same pitch of perfection as the steam-engine at the present day as a thermo-dynamic machine. It was better, but not relatively so good as it should be. Now about running gas-engines as bad as it could be done. If they were to make a research, they must not always run at the maximum efficiency, or they could not see what an engine would do under varying conditions. It was not his business to always be running at maximum efficiency. He was not a gas-engine maker; if he were, he would not be reading papers. (Laughter.) The President, in his opening remarks, stated that this portion of the work was that which dealt with the anatomy of the gas-engine. They had dissected it out—perhaps wrongly; but they had made the attempt. These were the only series of experiments under varying conditions that had been made on a gas-engine. There were no other experiments in the whole literature of the world, so far as he was acquainted with it, in which more than half-a-dozen experiments had been made on one gas-engine. There were series of experiments on a steam-engine. The Committee's next task would be of a quite different nature—viz., they had got to say in the next place what were the directions in which the efficiency of gas-engines were to be improved. That was a different problem altogether. They would have to consider the question of governing gas-engines, and whether throttling or hit-and-miss was the correct system. They had also to consider the question of the mixing of the air and gas by a mixing-valve, as in the Westinghouse engine or some other contrivance; and to investigate the effect of scavenging or non-scavenging. Together with these things, they had to make a determination of the temperature in an engine whose cylinder was absolutely symmetrical.

The PRESIDENT, in thanking Professor Burstall, said the discussion would be of great assistance to the Committee, who were most desirous that the work they were carrying on should be of use to every user and every maker of gas-engines.

AN AUTOMATIC GAS STOPCOCK.

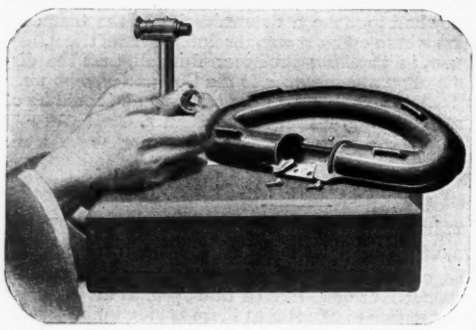
Gas has often been accused in the columns of the daily Press and by firemen, with having been responsible for increasing the fury of a conflagration, when it has been impossible to quickly sever the gas connections or to turn off the supply at the meter or elsewhere. We are free to admit that there is foundation for the charge in some cases, just as doubtless the partisans of other forms of lighting will agree that their particular *protégé* is at times guilty of starting a fire. But means are now provided by which the risk of gas augmenting fire may be avoided. Meter-cocks may be in inaccessible positions, or it may be difficult or inconvenient to turn off the gas supply from the street; but there can be no occasion for great alarm if an automatic patent gas stopcock is adopted. Such a tap (appropriately called the "Salvage") has been brought to our notice. Its automatic action is accomplished by an inner or second plug, which is kept in a raised position by a composition that melts as the heat reaches it. This melting of the supporting composition releases the plug, which descends and automatically closes the tap. In the illustration, the inner plug is shown held in position by the composition A. It requires no further words to show that, if fitted in place of the ordinary tap on the service-main at the meter, or at suitable positions throughout an installation, a stopcock of this kind will be found of incalculable value in case of fires. The expense of making a provision of this sort must be looked upon as the payment of a small premium for a perpetual insurance against the increased risk which may attach to the presence of a gas supply in any building. The tap here illustrated and described is being introduced by Messrs. Falk, Stadelmann, and Co., Limited, of Farringdon Road.



RICHMOND'S GAS-FIRE IMPROVEMENTS.

In outward appearance, the designs of the gas-fires that the Richmond Gas-Stove and Meter Company, Limited, are placing on the market this season are very similar to those with which they sought public favour twelve months since. In other words, the artistic merit and general finish of a year ago were in every whit as good as what we have presented to us by the firm to-day. There have been changes; but they are only changes, and they have not carried the stoves into a higher rank of beauty, nor, let it be said, have they reduced them. However, by this we do not intend to convey the idea that the firm have stood still. They have not. They have introduced with success several improvements in structural details during the past few years, and many a good word has been said for them by engineers capable of judging of their performance. In this season's better class type of fires, the firm have embodied these improvements, without asking of the buyer any additional expense for the benefits conferred. For example, the fires in the "Triumph" series have this season been provided with a pair of wings pivoted under the canopy, and adjustable to three positions. In the case of sluggish draught, or until the flue is warmed, these wings may be lowered like a hood, so as to quicken the draught; and in this way the unpleasantness which occasionally arises in rooms, through defective flues, when gas-fires are first lighted, is averted. We know that some users of gas-stoves will welcome this improvement if it is effectual under all such circumstances.

Then Richmond's patent water gas attachment (which was noticed in our "Register of Patents" on July 2 last) is now being fitted to all the Company's asbestos gas-fires. It can be adapted to suit either water gas or coal gas by adjustment, and experiments with it at Plymouth have supplied the justification for the statement that by its use gas-fires will burn splendidly with a mixture containing even the large proportion of 70 per cent. of water gas. Towards the end of 1899, Mr. F. G. Dexter, of Winchester, had this attachment under test; and his report was extremely gratifying. The importance of an adjustable air supply to laboratory and other atmospheric burners has long been recognized; and Mr. Dexter said this arrangement was the first attempt (within his knowledge) to apply this important principle to gas-fires. In his communication to the Gas Institute in the previous June, he drew attention to the considerable difference in the air supply required for gas-fires working with coal gas and carburetted water gas respectively. In his experiments, the attachment, applied to a "Dragon" gas-fire, permitted any mixture containing up to 50 per cent. of carburetted water gas to be used with the certainty of stopping hissing, cracking, and tendency to light-back. Ordinary burners, consuming (say) 30 to 40 per cent. of water gas, give a short cracking flame, which does not reach the upper layers of fuel; but the Richmond air-adjuster permits the whole fire to be made incandescent, and stops noise. The attachment was fully tested by Mr. Dexter at all pressures, from 6-10ths up to 2 inches, and from coal gas alone to mixtures containing 10, 20, 30, 40, 50, and 70 per cent. of carburetted water gas. In his opinion, the arrangement should be applied to all gas-fires; and, as already stated, the firm have now adopted that suggestion.



Among other improvements, all the Company's condensing-stoves are being supplied with a governor to pass the correct quantity of gas for ensuring perfect combustion. Quite a new feature in the firm's fires are the hinged fronts and removable burners and fire-bricks. The front is simply kept in position by a small thumb screw, on releasing which, without removing the front, the fuel, the fire-clay brick, and the burner can all be removed, for either cleaning or repair, with the greatest possible facility. The number of the patent for this improvement is 4432; and the specification is dated March 1. This new and useful departure is being applied in the case of all the firm's best new types of fires. The ease and rapidity with which the fires can be taken to pieces will make the arrangement popular with both gas fitters and consumers. The larger illustration shows its application to the firm's speciality for this season, the "King Edward" fire. This stove is indeed very ornamental and superior-looking; and it gathers within its frame all that the makers consider of value in the making of a good and efficient fire. In designing it, they have aimed at securing the maximum heating power in a small compass. It possesses an improved duplex burner with dial tap, which gives, it is claimed, a great range of power with the utmost simplicity and safety in use. An easily accessible water-pan is arranged within the top; and other of the improvements already mentioned have been incorporated. Another of the firm's special lines is the "Dragon" condensing stove, which also has its own features of interest. It is bold and striking in design, and is provided with a projecting canopy in order that no fumes may escape. The condensation appears to be very perfect. In one of the large-sized fires, consuming 20 cubic feet of gas per hour, the pan (16 in. by 9 in. by 1½ in.) in which the condensation is received has to be emptied daily. From this

stove there is a very powerful diffusion of heat. Passing reference must also be made of the "Maidstone" gas-fire, which has been specially designed for prepayment meter supplies. The burners are after the Kern principle. There is no central air chamber as usual; the mixing-chamber being provided at the side. The fire is designed to fill a place in the bedroom similar to that now occupied by the slot cooker in the kitchen. It is certainly a very effective fire; and its heating quality is remarkable for its size.

Coke-Oven Gas for Driving Gas-Engines.—The "Bulletin de la Société de l'Industrie Minérale" lately contained a communication by M. Reumaux to the Congress of Mining and Metallurgy in Paris, in which he described an application for the production of power, at a group of bye-products ovens at Lens, from the gas remaining after heating the ovens. It was utilized in a Letombe double-acting engine driving a dynamo. The quantity of gas disposable, under favourable conditions, from 120 ovens, burning 7-ton charges in 36 hours, was 1000 cubic metres (35,300 cubic feet) per hour, which, at 850 litres (30 cubic feet) per horse-power-hour, corresponds to 1200-horse power, or 10-horse power per oven. The heating value of the gas was 4200 calories per cubic metre at 15° C. The author gave in tabular form the data of two trials of the engine; the average power realized being 21·99 and 24·53 indicated horse power for a consumption of 827 and 773 litres (29·2 and 27·2 cubic feet) of gas respectively.

The Korting Gas-Engine.—Among the abstracts of scientific papers appended to the last volume of the "Proceedings" of the Institution of Civil Engineers, is one of an article in the "Engineer" giving the results of a trial of a 350-horse power Körting gas-engine carried out by Herr Meyer at Messrs. Körting's works. It was a two-cycle engine with one double-acting cylinder (like a steam-engine), having a piston-rod and cross-head working through guides, and a crank. The diameter of the motor cylinder was 21·6 inches, and the length of stroke 37·7 inches; the diameter of the air-pump was 24·4 inches, and of the gas-pump 19·6 inches—the stroke of both being 27·5 inches. The engine was driven by gas made in a Körting producer, and the work was absorbed by an electric brake, which was not very reliable. The consumption was recorded by a large gas-meter; and the lower heating value of the gas frequently measured by a Junkers calorimeter. The mean (metric) effective indicated horse power in a trial run of one hour at full load was 481; the mean power on the brake, 341·5—the mechanical efficiency being 71 per cent. The consumption of gas per brake horse power was 81·5 cubic feet; and the thermal efficiency of the engine per brake horse power, 23·8 per cent. The consumption of gas could not be quite satisfactorily verified. Assuming it was 4 or 5 per cent. above the figures given, the utilization of the heat was very good—viz., 24 per cent. of the heat supplied to the engine converted into useful work on the brake.

RAINFALL AND VILLAGE WATER SUPPLIES.

[Abstracts of Papers, with the Discussions thereon, presented to the Conference on Water Supplies and River Pollution.]

The Rainfall and Population of England and Wales in Relation to Water Supplies.

A very valuable contribution was made by Dr. H. R. Mill, of the British Rainfall Organization, under the above title. After explaining the origin of rainfall, the author remarked that it might with perfect truth be said that all fresh water was rain, and that the process of evaporation by the sun's rays and condensation by the cold air was one of purification—freeing the water of all foreign substances dissolved by running over or percolating through soil or rock. Rain was brought to this country chiefly by the prevailing south-westerly winds. It was condensed mainly over the higher lands, which in England and Wales rose to the west of the central meridian of country. It ran off rapidly down the steep slopes of bare impervious rock, slowly over the gentler slopes of soil, and sank into the outcrops of permeable strata, from which it might emerge in the form of springs, or remain stored deep underground as a supply that could be tapped by deep wells.

Rain was the life-blood of every country; and all the conditions determining its distribution over the land and its subsequent fate demanded most careful study. The British Government had supplied, by the wise expenditure of public money, the fullest information as to the configuration and the geological nature of the country. Public money had also provided, through the Meteorological Office, a satisfactory knowledge of the prevailing winds, and a fair approximation to the law of the storms affecting the islands; and possibly some day the increasing knowledge of meteorological and geographical laws might enable one to construct a map of the theoretical distribution of rainfall by *a priori* reasoning from such data. That time had, however, not yet come; and the local variations of rainfall were so numerous and imperfectly understood, that the actual distribution could only be ascertained by accurate and long-continued measurements. The stations maintained by the Meteorological Council, while sufficient for the purpose of supplying storm warnings and weather predictions, were not nearly numerous enough to give a fair idea of the distribution of rainfall. Nor were the more thickly-planted stations of the Royal Meteorological Society, who had done, and were still doing, splendid work on the climatology of the British Islands, sufficient for this purpose. In most countries a special rainfall service, with numerous observing stations, was maintained by Government, if it was carried out at all; but they alone among the nations of the world had acquired the habit of doing work of national importance by private initiative and voluntary association. No better instance of such a work existed than the British Rainfall Organization, created by the late Mr. G. J. Symons. He devoted his whole life to the task; and at the time of his death, he had succeeded in raising the number of complete annual records of rainfall in the British Islands to 3500—a number unapproached in any other country, yet not one too many for the purpose. Mr. Symons never failed to acknowledge and to insist upon the fact that his work would have been impossible but for the cordial co-operation of the thousands interested in scientific observations or impressed with the practical importance of the study of rainfall. It was a matter of great satisfaction to his successors that the observers organized by Mr. Symons continued to carry on their self-imposed labours.

The task of combining the records of the past forty years so as to give a map of the normal distribution of annual rainfall over the whole country, had not yet been completed; but the question had been sufficiently studied to show that, as regards England and Wales, the main features of the map compiled by Mr. Symons for the Rivers Pollution Commission in 1867 would not be greatly altered on the scale upon which it was published. There would, of course, be many minor modifications of importance for particular localities; but looked at generally, the map still held good. It showed that, with the exception of the North Yorkshire Wolds and a small area on the Chiltern Hills, the rainfall was under 25 inches over the whole of the East of England, included between a line drawn from Shields to Reading (roughly $1\frac{1}{2}^\circ$ W.), and a line drawn from Reading to Margate (roughly $51\frac{1}{2}^\circ$ N.). This area of low rainfall measured about 20,000 square miles. It was almost entirely composed of low-lying land built up of secondary or tertiary rocks, and forming a series of plains and scarped slopes, with the edges of the escarpments running in a curve from south-west to north. This region contained, except London, few towns exceeding 100,000 in population; and the small towns and villages were grouped with a remarkable relationship to the geological character of the land. Thus, where the chalk or the limestone strata of the Oolitic series came to the surface, their outcrops were almost uninhabited; but where beds of clay or of sandstone bordered the calcareous outcrops, strings of villages and small towns were arranged parallel to the strike of the strata.

The region of light rainfall contained some of the best and most highly farmed land in the British Islands; and except for the clay-covered slopes of the wolds and moors in the East and North Ridings, it was on this account rarely suited for the collection of a water supply from the surface. It was frequently possible to obtain supplies from deep wells fed by the rainfall that found its way through the numerous outcropping beds of porous rock. The rivers taking their rise in wetter parts of the country to the west were also a common source of supply; but, in the author's opinion this was an undesirable source, since the river that "watered" a country also "drained" it. The remoteness of the greater part of this region from the region of heavy rainfall, made it hopeless to consider the introduction of water from a great distance, except in such an abnormal massing of population as in London, where the urgency and magnitude of the demand justified exceptional expenditure.

The rainfall over the centre of England was also under the average for the country, ranging from 25 to 30 inches. This portion, measuring about 17,000 square miles, included the Yorkshire Wolds, a strip from 10 to 20 miles wide bordering the dry Eastern area, and the plain and hilly region stretching from the Mersey to the Bristol Channel. It included a large proportion of fairly elevated, but generally level and undulating, land, ranging through the whole geological series from the chalk to the silurian; and its character was so diverse that it could not well be treated in a general way. The southern part was thinly peopled, and in the main dependent for its water supply on wells; the central and northern parts carried an extremely dense population, including many large manufacturing towns—among them Birmingham, which was preparing to obtain its water supply from the rainy regions of the West.

A rainfall of from 30 to 40 inches prevailed over about 11,000 square miles, along a thinly peopled belt of the south coast of England, the line of the Mendip and Cotswold Hills, the east of Wales, and also over the eastern slopes of the Pennine Chain, where the valleys were thronged by a dense industrial population, although the intervening moorlands were without villages and in most parts uncultivated, as well as south of the Pennines, in the south of Lancashire, and in parts of Cheshire, Stafford, and Derby, which collectively formed the most densely peopled part of all England. The land subject to rainfall of this degree of intensity was usually steeply inclined and fairly high in the thickly peopled part; and since the population was massed in the valleys or on the bordering plains, the configuration lent itself to the impounding of surface water in reservoirs and the supply of towns from the high ground immediately surrounding them. But the growth of population in such centres as Liverpool and Manchester was so rapid, and the demand for water so great, that they had been forced to go far afield into the wettest districts for their supply.

The wettest districts consisted of nearly 4000 square miles, with a rainfall exceeding 50 inches, rising in several small areas to over 100 inches, and surrounded by about 6430 square miles in which the rainfall exceeded 40 inches. The regions with a rainfall of 40 inches or over were to the west of the meridian of 2° W., which marked the central line of England and Wales; and they were three in number, corresponding to the three prominent projections of high land on the west coast—the English Lake District with the western edge of the Pennines, western Wales, and the Peninsula of Cornwall and Devon. The greater part of each of these areas was practically uninhabited. They were all mountainous or hilly districts formed of the most ancient, hardest, and least permeable rocks in the whole geological series. More than this, the Welsh and Cambrian mountain valleys contained a remarkable number of lake-basins at various elevations above the sea, some intact and filled with fresh water, others silted up or breached and empty, but capable of being restored to their function as reservoirs—a feat which had been accomplished in the case of Lake Vyrnwy. It was only in these regions (Wales and the Lake District) that they found all the great *desiderata* brought together—high land facing a prevailing sea wind, a consequent rainfall equalled in few parts of Europe, bare and impermeable rocks giving a quick run-off of pure water in the higher peaks, absence of population and agriculture, ensuring freedom from pollution or local demand, and many vast reservoirs or favourable sites for constructing them.

The distribution of rural population in lowland England had been shown by several writers to be largely influenced by the facility of obtaining a water supply from springs or shallow wells. The wells, in fact, were the chief causes of the growth of country villages. The concentration of population in industrial areas had had the effect of bringing the densest population of the country to the coalfields; and from the position of the outcrops of the coal measures in England and Wales, the chief coalfields were close to the lower slopes of the mountainous regions of ancient rocks which occupied the greater part of Wales, the Pennine Chain, and the Lake District—being thus in the most favourable position for obtaining a supply of water by gravitation from mountain or moorland gathering-grounds in the area of heaviest rainfall.

The average rainfall of the whole of England and Wales was probably about 33 or 34 inches per annum. The present population was, in round numbers, $32\frac{1}{2}$ millions; and as the acreage was 37 millions, the density was something less than one per acre. The fall of 1 inch of rain per annum on 1 acre was equal to about 62 gallons per day; hence it appeared that the collection of 1 inch of rain per annum, or less than one-thirtieth of the average fall, would supply 70 gallons of water per head daily. They knew that the population had almost exactly doubled since 1851; and its present rate of increase was 12 per cent. in ten years, or 1·2 per cent. per annum. From considerations other than that of water supply, the author believed that the maximum population which the country could support would not very greatly exceed twice the present number; and even that would

allow a supply of 35 gallons per head from one-thirtieth of the total rainfall. These figures seemed to show that there was no cause for anxiety as to the future of the water supply; and, as a matter of fact, he thought they had rain enough to satisfy all the demands that were ever likely to be made upon it. But averages were never more deceitful than when used in such discussions. They had to remember that average-rainfall years rarely occurred; and that it was necessary to provide for exceptionally dry years—perhaps several consecutively. They must bear in mind also that the demand for water was increasing much more rapidly than the mere growth in population would suggest; and that the increase in population acted by restricting the available areas of uncontaminated gathering-grounds, as well as by the consumption of a larger amount of water.

The increase in the legitimate use of water was in many places taxing the available sources of supply. But the most serious question to consider was the increasing stringency with which the purity of the water supply had to be safeguarded. Since the remarkable power of a polluted water supply for the dissemination of disease had been recognized, steps had to be taken to secure pure water by going to a source beyond the reach of contamination by sewage or manures, and to safeguard it further by filtration or other treatment.

When they remembered that the population was not only increasing in number, but also shifting in distribution, they came to another element of present interest and possible future anxiety for water supply. The last census had shown that (notwithstanding the general increase) in six counties the population was practically stationary; and in no less than twelve counties there was an appreciable loss of population between 1891 and 1901—in some cases, as much as 5 per cent. Other counties had increased their population greatly during the ten years. Glamorgan, for instance, by 28·5 per cent.; and Northumberland, Worcester, Derby, and Nottingham, all by over 18 per cent. The counties immediately surrounding London were so phenomenal in their increase that they must be considered apart. Thus, although the County of London itself only increased by 7·3 per cent. in the last ten years, Middlesex increased by 46 per cent., Essex by 41 per cent., and Surrey by 24 per cent. This indicated a tendency towards concentration in particular areas—some (such as Glamorgan, Northumberland, and Derby) well situated for obtaining an abundant water supply, but others (like the neighbourhood of London) so placed as to arouse very serious anxiety for the future. The concentration of population in large towns, other than London, was not included in these estimates, and formed by far the most disquieting element in the general redistribution of the people which was now in progress.

The present dearth of water in Manchester and the other large towns of the North of England, was the result of a succession of unusually dry months; but such a dry period had happened before, and should be taken into account in planning reservoirs or aqueducts. If there had been a double or triple pipe-line from Thirlmere, the Manchester supply would probably have been sufficient for the demand; and the fact that the supply had to be restricted was only an incident due to works, the necessity of which was understood, being still unfinished.

The question of the possibility of obtaining supplies was not in doubt at all; but in many localities the cost of keeping pace with the requirements would undoubtedly be great, and might in certain circumstances become prohibitive. Hence it seemed right to sound a note of warning, and to direct general attention to questions of economy that had long received the attention of engineers and of students of the larger geography of the present day, but which had not yet been brought home to the public at large. It was not the water that was used, but the water that was wasted, which gave cause for anxiety. He would urge most strongly that, whatever methods of economy were recommended, the diminution of the amount of water used for washing, bathing, and even for drinking, should never be suggested or countenanced. For years to come, the prevention of waste would be the most important of all economies; and to prevention of waste by the regulation and inspection of fittings, and the education of consumers, the author looked for the chief protection against water famines. No doubt the supplies in most places must be increased; and in many there was great need for a larger and more constant supply, which must be seen to. Money which reduced the death-rate and raised the standard of health was well spent, although the benefits conferred by it could not always be reduced to that lowest common denominator £ *s. d.*

At present there remained nearly 4000 square miles of totally uninhabited land in large connected areas in England and Wales, of which 1400 square miles was found in the mountains of Wales, 1400 square miles in the higher moorlands of the Pennine Chain, and 300 square miles in the Lake District. All of these were high areas of very heavy rainfall, quite well adapted for use as gathering-grounds. The remainder was partly high land on the chalk and limestone ranges of southern and eastern England, partly fen and alluvial land—all rendered useless for gathering-grounds on account of permeability or low level, but often forming valuable feeders for springs and deep wells. A great part of the suitable ground was already appropriated to the supply of large towns, or was "pegged out" with a view to the future extension of water-works. Nearly the whole of the Pennine Chain and a great part of Wales was in this position. It was a question worth raising as to how far the community at large should allow such appropriation to go on in the present way, by which supplies in excess of their requirements might be locked up by towns to the prejudice of neighbouring districts. Rainfall, like the air itself, might be considered as outside the bounds of private property; and there was at least one argument which might be brought forward in support of the view that rain belonged to the nation. It was that nearly the whole supply for the country came in from the west, and that a large proportion of the fall in the district which enjoyed a fall above the average fed the rivers which flowed across the drier plains of the east, and if diverted would depreciate their value.

They must not, however, confine their attention to the wants of the large towns. The supply of rural villages was even more urgent. A very large proportion of the town-dwellers were villagers born and bred; and the health of the whole country depended more than was usually recognized on the hygiene of villages. Villages existed in many parts of England which would be a disgrace to any country in Europe, on account of their defective or non-existent drainage and water supply. The danger of the shallow wells of such villages need not be dwelt upon; but it was surprising that the very simple remedy suggested in a paper by Mr. Sowerby Wallis, read at the Croydon Congress of the Sanitary Institute in 1879, had not been more widely applied. He showed that by combining roof-collection with proper storage tanks, the rainfall, even of the drier parts of England, would provide a sufficiency of the purest water at very small expense. Even where a supply from deep wells was available, the collection of rain water from roofs was often very useful on account of the wastefulness of hard well water in the use of soap; but the old water-butt must be abolished, and a clean, closed, water-tight underground tank substituted for it. For the majority of the villages in the dry parts of England, where most of the village population of the country was to be found, the direct collection of rain would, the author believed, solve a pressing problem. It would not be difficult to adapt the roofs of churches also for this purpose; and it might even be worth while to extend slated house-roofs over back yards, in order to increase the area.

Discussion.

Dr. MILL supplemented his paper by a few remarks. He said that all pure water was rain water; and the purer it was, the nearer was it to rain water. The practical problem was: How were they to catch the rain water with the minimum of mixture with other matter? But in his communication he also referred to another practical question; and it was this: The rain came to this country mainly, or almost entirely, from the west or south-west. Was it to be the rule that the rain which fell on the high ground in that part of the country should be given to the very small section of the community indeed who were living upon those gathering-grounds; or was it to be declared that the rainfall must follow the population? The people of Devonshire, like the people further north, and like those of Wales, were expansive people. A great many came to London and other large centres. Was all the water to be kept for those who remained at home; or should the water follow the drift of the population from the portions of the country which were too wet to the great towns? There was one other thing he would like to say. It was almost impossible to determine what was really the true average rainfall of any part of the country, unless regular observations were made of the amount extending over many years. He had taken up the work of the late Mr. Symons; and he was determined to do his utmost to carry it on in the same very able manner that that gentleman had done.

Mr. J. W. LIVERSEDGE (Ashton-in-Makerfield) remarked that Dr. Mill mentioned one point which seemed very interesting—that was, with regard to the purity of water. He made the statement that the nearer the water supply was to the rainfall, without contamination from the land, the greater was the purity of the water. That was to say, the nearer the water approached the condition of the rain as it came down, the purer would the supply be. He had thought over the question; and it seemed to him that it came to this: Instead of collecting water from upland surfaces or cultivated lands, was it not within the limits of practical engineering to create impermeable surfaces—inexpensive, artificial surfaces—that would collect the water which Dr. Mill had referred to, and take it down directly to the reservoirs? Was it absolutely necessary that the water should pass first through the cultivated land, before being received into the reservoirs; or was not some such plan as he had suggested practically possible? He should like to ask this question. There was a considerable amount of rainfall in the summer months; and if this could be quickly secured, and carried to the reservoirs, it would increase the water supply to a very great extent.

THE DESIRABILITY FOR REPORTS ON THE WATER SUPPLY OF EACH COUNTY.

This was a contribution by Dr. Alfred Greenwood, Medical Officer of Health for the Borough of Crewe; and in it the author enumerated the various points regarding the water supplies of different counties on which full reports (on the lines of that compiled by Dr. Thresh on the water supply of Essex) would be of use, and some of the resulting advantages. He remarked that very many reports had been written which dealt fully with the water supply of large towns; but similar information regarding rural districts was wanting. Certain factors, such as the character of the subsoil and the contour of the hills, remained fairly constant in their influence on water supplies, though, of course, they varied

in different localities; but other factors, such as rainfall and population, continually changed in such a way as to affect materially the questions of existing and future requirements of water. Information regarding these two points would be desirable for each county—viz., (1) The characteristics of the existing water supplies; and (2) the future requirements.

A few statements regarding rainfall would be of interest in this connection. All supplies of fresh water came primarily from rain. The great range of the rainfall in England might be seen from the facts that the largest annual rainfall was 146 inches, at Seathwaite, in the Lake District, and that the driest part of the British Isles was an extensive district to the south-south-west of the Wash, with an annual rainfall of about 21 inches. Most of the remaining parts of England had an average annual rainfall of about 30 inches. The county of Essex had suffered especially from deficiency; and in 1898 the rainfall of that county was less than 17 inches. Moreover, the average annual rainfall in England had decreased since the year 1880; and at present they were experiencing a period in which it was below the average of the last fifty years. The decline was more marked in some parts than in others—viz., in the eastern and south-eastern portions. From this, it was evident that some districts did not have the same opportunity of adapting the rainfall to their use as others; and it had been stated that the water from this source was not put to sufficient use, so as to give the maximum amount of benefit. While admitting that a greater amount of rain might be properly conserved and adapted for use than was at present the case, it was very important to consider the amount of water yielded by rainfall in the district concerned. In some places rain-water tanks had been erected; and then, owing to the very low rainfall of the district, they had been found of little use. It was therefore extremely important that information should be obtained regarding the rainfall for several years previously, in districts where it was intended to construct large rain-water tanks. It was also important to know other details respecting the rainfall of a county—such as that portion of the year during which it was greatest. Thus the greatest rainfall might occur in the early autumn, when the ground was absorbent and evaporation high. Hence, monthly, as well as yearly, records of the rainfall were required. Therefore it would be necessary to include in these reports information concerning rainfall, character of subsoil, and contour of hills. Note should also be taken of the amount of agriculture in each county, since extensive manuring of the soil increased the risk of contamination of shallow wells and streams. Accurate information would be needed concerning the rivers and streams of the country—their source, situation, course, natural altitude, and the areas drained. It would also be necessary to have comparative readings of the flow of all the rivers of a county at fixed points, and at stated times. Comparative readings during the driest and wettest parts of the year would be useful. Particulars respecting the wells would be necessary, in reference to their number, character (whether deep or shallow), construction, surroundings (possible sources of pollution), and the number of houses supplied by the wells. Inquiries should be made respecting any possible connection between epidemic diseases, such as typhoid fever, and a polluted water supply. An attempt should be made to ascertain the amount of river pollution; and the results of chemical and bacteriological examinations of water from various parts of the county should be periodically recorded. Regarding the future requirements of a county, it would be necessary to estimate what the population would be a few years hence. As they had recently received the census results, any estimates of population for the next few years would be more correct than they had been during the last few years. These were some of the leading points which would require notice in such a report, and which it would be necessary to keep up to date.

Among the results of these reports, would be included the following advantages: (1) Clear indications would be given of those districts in which the water supply was deficient. (2) Those districts would be known in which there was a liability to contamination through using drinking water from shallow wells, ponds, &c. Although persons might drink impure water for long periods with impunity, sooner or later they must pay the penalty—in fact, directly the water became infected by disease-producing organisms. (3) The available supply, and the sources from which a supply of water could be obtained in the different parts of each county, would be known definitely. It might be necessary, from increased population, to supply one district with water from another. Hence the importance of a full knowledge of the available supply in the various districts. (4) It was well known that improvements were needed in the legislation respecting pollution of water supplies, prevention of waste, establishment and control of water-works, and various other points. The demand for these improvements would have more weight if supported by additional information respecting each county. (5) From a consideration of such reports, very useful conclusions would be drawn and recommendations made. For instance, those situations where it would be desirable to sink deep wells would be ascertained, and *vice versâ*. Also such facts as the following would be brought out: That the multiplication of deep wells in certain areas caused an increase in the rapidity of the level-fall. (Hence the importance of accurate records of water-levels at different periods.) Other causes of diminution in the yield of many wells would be discovered, such as the silting of the bore-tubes with sand, &c.

In conclusion, the writer submitted that, if reports arranged on similar lines could be compiled for each county, the results would be of the greatest importance, and commensurate in every way with the trouble and expense involved.

Discussion.

Dr. HODGSON (Cheshire County Council) said that if they asked for further powers from Parliament with reference to the control of water supplies, they would be sure to be met with questions as to whether or not County Councils were exercising the powers they already possessed. It was very important, therefore, that they should consider whether there was being done what was possible by County Councils in this matter. It was most essential, of course, that there should be no antagonistic feelings between County Boroughs and County Councils with regard to the question of water supply; there must be concerted action. There was no doubt that the paper touched one of the greatest troubles of the present day, which was, that County Councils were not using the powers they already possessed. This was precisely what the Local Government Board said. He had been on several deputations to the Board; and the question that was always put to these deputations was: "Why do you not exercise the powers you already have, before asking for more authority?" There was not the slightest chance of further legislation until County Councils could say they were ready to act. The powers they possessed were these: It was within the province of the County Council to provide water for the districts in their area. Any Parish Council, if they complained to the Rural District Council in whose area they were situated that they had not a proper water supply, and the Rural District Council did not provide it, could again complain to the County Council; and the County Council had authority to provide a supply. Therefore, the first thing was to be informed as to the position of the water supply. Parish Councils had not the means of obtaining this information; and therefore grievances were only formulated when they became most glaring. But County Councils had the power of investigation. They had expert officials—or, if they had not, they ought to have, for they were authorized to provide them. The first thing, therefore, was to urge the County Councils to put themselves in order, and provide themselves with the officials they needed. If the Councils would do this, and instruct their Medical Officers of Health, Surveyors, and Analysts to prepare a record of the existing water supplies within their areas, a very great deal would be done towards providing a proper supply for the people. If County Councils did not exercise their powers, why did they not? They were not likely to obtain information unless they sought it; and they were the proper persons to seek it. He hoped, therefore, that, as the outcome of the Conference, there would be a determination to secure this information, and that, when it was obtained, action would be taken upon it. County Councils had great authority already with regard to the pollution of streams. In Cheshire most persistent inquiries were instituted on this subject. But the matter wanted to go further; and it was very difficult for the first County Council to step into a conflicting area of opinion like this, unless they found encouragement from some experienced body. He trusted, therefore, that they would use every endeavour to do what was already within their authority, before complaining and asking for powers which up to the present time they did not seem to have deserved to possess. Under these circumstances, he desired to propose a resolution to the effect that County Councils should be urged to investigate the existing position of the water supplies within their districts, with special reference to the quantity and quality of such supplies; that the real or probable contamination of springs, wells, and streams used for potable purposes should be particularly noted, with chemical and bacterial analyses; and that attention should also, if possible, be directed to such additional or improved sources of water supplies as might be provided at a reasonable cost.* The last point was the *crux* of the difficulty. It might be said that County Councils were prevented from taking any action in the matter. But he would refer them to the Local Government Act of 1894, which contained very definite provisions on the matter. He alluded to clauses 1 and 2 of section 16. Under these circumstances, he trusted that County Councils would act upon the powers already granted them.

Mr. PERCY GRIFFITH, Assoc.M.Inst.C.E. (London), said that he represented the British Association of Water-Works Engineers; and he was glad to say that a large number of their members were present at the Conference, and had been following the discussion with great interest. It was a fact perhaps not known to all in the room, but certainly known to their hosts the Sanitary Institute, that the Association had been taking a keen interest in the subjects before the Conference, and had been endeavouring, to the best of their ability, to hit upon some practical means of effecting remedies for what were generally acknowledged to be existing evils. The difficulties, of course, were very great; and it was not possible at the present time to define exactly what could or should be done. But it was certainly a fact which bore more particularly upon the paper at present under discussion, that the British Association of Water-Works Engineers had now definitely decided to proceed at once with the collection of data in regard to the water supplies of this country. In the absence of any parliamentary authority or compilation, of course it was not to be expected that any private body could make such a return as complete as was to be desired; but at the same time,

* As previously reported (*ante*, p. 1037), this resolution was subsequently carried.

he, as Secretary of the Association, had been asked by his Council to mention the fact to the Conference, with the view of inviting the assistance of all those who were interested, and acknowledged the necessity for this course to be taken, in the efforts which were about to be made.

The Rivers of Glamorganshire.

A very full description of the rivers of this and adjacent counties was furnished by Dr. Williams, Medical Officer of Health to the Glamorgan County Council. Though of great statistical value, much of this paper was not of general interest; and it is therefore only possible to notice some of the more salient points of the communication, as well as the conclusions arrived at by Dr. Williams. The river system of South Wales, the author remarked, was very simple; the chief rivers running in more or less parallel courses in a southerly direction. Some of them had their sources in the Brecon Beacons; while others flowed from the hilly country of the northern outcrop. The general trend of the surface was towards the south; so that the streams flowed very rapidly throughout their whole length, and few were navigable even to the level of high tide. Their direction across the coalfield, and through the ridges formed by the outcrops of the harder rocks, seemed to indicate that their origin dated far back into geological times. Several of the streams were along lines of weakness in the shale. The distance inland from the coast to the sources of the rivers was rarely more than 30 miles (in a straight line); but the rainfall being heavy, and the fall of the ground considerable, the bulk of water coming down was very large, and most of the rivers partook of the nature of mountain torrents.

One of the greatest troubles experienced was the pollution of the rivers by small coal from the collieries; and in 1893, the Glamorganshire County Council took legal proceedings against the proprietors of a certain colliery for offending in this respect. The case was, however, dismissed; the verdict being that small coal was neither a pollution nor a permanent obstruction to the flow of the water in the river bed.

The Neath Rural District Council were at present formulating a water scheme; and plans, &c., were being prepared with a view to promoting a Bill in Parliament next session. The collecting area comprised the Mellte, Hepste, and Dringath streams, which were tributaries of the River Neath. The collecting area, comprising some 1000 acres, was situated in the parish of Ystradfellte, in Breconshire, and was very rich in springs and streams. It was proposed to serve from this source all the places within the District Council's area at present inadequately supplied. It was also intended to provide, if and when required, an additional supply to Aberavon, Briton Ferry, and Neath. There was one tin-works on the River Neath, and one on its tributary the Dulais; and in its course to the sea it received the sewage of several villages, and into its tidal waters the sewage of Neath and Briton Ferry. The proposed Ystradfellte water scheme was much wanted; and the need became more urgent year by year.

From the descriptions given by the author, it appeared that all the Glamorganshire rivers had their origin within the county, or in the mountainous and uninhabited regions immediately beyond the northern boundary of the county, at an elevation varying from 1000 to 2000 feet. They were consequently comparatively short and swift-running (the longest being no more than 40 miles); so that their pollution took place almost entirely in the county. Therefore it should not be difficult (as in flat countries) to abate it. Besides, no Joint Rivers Boards were necessary. The water of none of the Glamorganshire rivers was employed for drinking purposes after any sewage had been discharged into it. Such a condition of things was highly satisfactory as compared with other important rivers—such as the Dee, Severn, &c. The principal pollutions of rivers in Glamorganshire were occasioned by sewage, small coal, and refuse from tinplate works.

Much work had been done during recent years with a view to preventing the pollution of the rivers by sewage; and as far as sewage was concerned, the writer did not anticipate any difficulty now that the requirements of the Local Government Board with respect to land were altered on the recommendation of the Royal Commission on Sewage Disposal. In some of the long, narrow, and crooked valleys, it was impossible to acquire sufficient areas of land, within reasonable and suitable distances, for sewage disposal purposes. In all the county there were thirty sanitary districts; and out of these, thirteen, representing a population of some 516,000, discharged their crude sewage into tidal rivers and the sea; and the sewage of some nine, or parts thereof, was treated on sewage farms, of which there were several. During the last ten years, through the action of the County Council, several old sewerage works had been improved, and many new ones constructed; and when the works now in progress were completed, the expenditure would reach a sum of over £600,000 in this period.

With regard to pollution by small coal, very little had been done, except in a few places where washing machines were used, and where the small coal contained in the washing water, and in the water pumped from the pits, was allowed to settle in large tanks, before it was discharged into the rivers. The author desired to obtain an expression of opinion as to what precautions County Councils could reasonably and legally expect colliery proprietors to take, with a view to lessening or preventing the discharge of small coal into rivers. As to the pollution caused by tinplate works, this was much less than was the case a few years ago. At by far the majority of these works, the "pickle," by the addition of scrap iron and continuous evaporation in properly constructed vats, was now completely converted into sulphate of iron or "copperas." The "swilling fluid" was in some places filtered through filters of broken limestone and of earth; and a large proportion of the acid and other impurities was thus got rid of, provided the filters were frequently changed. There was, however, a tendency to allow the filters to take care of themselves, which they were unable to do; and this rendered constant supervision necessary.

The conclusions arrived at by Dr. Williams were that, at any rate, in Glamorganshire greater progress would have been made in purifying the rivers had not the Local Government Board insisted, under all circumstances, on the hard-and-fast rule of land treatment in addition to artificial filtration; that it was important to have as many joint sewerage districts as possible in such a county, where the valleys were so narrow and land difficult to obtain; that no crude sewage should be discharged into the sea except after the most careful consideration of all local circumstances, and after experiments as to the directions of the currents at various conditions of the tide; that similar experiments and examinations of the water (chemical and bacterial) should be made in the case of tidal rivers and estuaries; and that the Government should countenance the establishment of Health Laboratories, where sewage effluents, manufacturers' refuse, and other materials discharged into rivers, estuaries, the sea, &c., could be thoroughly examined, and that these should be under the control of the County Councils.

Discussion.

Dr. Williams said he thought his paper might contain one or two points of interest. They had had in Glamorganshire a great deal of difficulty with regard to the pollution of rivers. Within recent years great improvement had been effected with respect to pollution by sewage and trade refuse; but towards remedying the pollution of the rivers by small coal, very little indeed had been done. He invited an expression of opinion as to what they could reasonably expect colliery proprietors to do in this matter. With regard to the duties of County Councils, one gentleman had just said that they were not doing what they ought, and that the Cheshire County Council were doing more than any other. In Glamorganshire, they had done at least a little. They had a record of the chemical analyses and the bacterial examinations of all the public water supplies of the county for the last two-and-a-half years.

Mr. William Fox, M.Inst.C.E. (London), remarked that he was intimately acquainted with the water supplies of Glamorganshire; and he had found that they were diminishing wherever they were near collieries. This was a very important point, because Dr. Williams had told them there were many works furnishing a large amount of water to big populations; and unless they looked out, it would be found before twenty years had passed that the works would not supply anything like the quantity that they did to-day. Dr. Williams had referred to a scheme which was to be brought before Parliament next year for supplying the area of the Neath District Council from the parish of Ystradfellte, in Breconshire. He might say that this scheme, with which he had been connected for the last five or six years, was only the first link in a large plan to supply the whole of Glamorganshire, or at least the greater part of it, by gravitation. Such a scheme would be far less expensive, and would supply water at a greater elevation, than any other suggested.

Dr. S. Rideal (London) said that Dr. Williams not only dealt with the rivers of Glamorganshire, but also with those of adjacent counties. It seemed to him that a difficulty would arise in getting statistical information from different counties, if they were not controlled by some central authority. It appeared hard that some counties should have work of this character thrust upon them which would involve heavy expense, while others would have very light duties to perform. Dr. Williams had to go and study the rivers in the adjacent counties before he could give an opinion on the water supplies of his own county.

Village Water Supplies.

In a paper entitled "Water Supply to Isolated Cottages and Small Groups of Cottages," Dr. J. C. Thresh, Medical Officer of Health to the Essex County Council, remarked that the Public Health (Water) Act, 1878, had signally failed in its intentions. In every rural district there were still to be found large numbers of cottages without any proper supply of water. All the sympathies of the framers of the Act appeared to have been on the side of the owners of existing property. As many difficulties as possible were placed in the way of sanitary authorities; and the owners were afforded as many excuses for delay, and as many causes for appeal to the Local Government Board, as could be devised. Finally, there appeared to be some objection to declaring the cost a private improvement expenditure, probably on account of the trouble of levying and collecting the improvement rate, which deterred Sanitary Authorities from taking action. Altogether, authorities seemed to consider that the improvements to be effected were not worth the trouble; and hence the little advance which had taken place in the water supplies in rural districts.

When new houses were erected, certificates were granted on supplies which were often most unsatisfactory. Authorities should insist upon the source being satisfactory and within a reasonable distance. The Inspector or the Medical Officer should examine the source; and, if thought desirable, a sample of the water should

be submitted to analysis. A certificate should be absolutely refused unless the water was perfectly satisfactory. Where the supply was to be from a shallow well, the owner and builder should know that the well would not be accepted as a satisfactory source of supply unless it was properly constructed and situated. For this purpose, the Chelmsford Rural District Council had had printed the following instructions, which the author strongly recommended to the consideration of other authorities:—

RURAL DISTRICT COUNCIL OF CHELMSFORD.

The Construction of Shallow Wells.

In the large majority of cases where shallow wells yield polluted water, it is due to defects in the construction of the wells. The following suggestions are submitted by the Chelmsford Rural District Council, upon the advice of their officers, for the construction of such wells. The water which enters a well at a depth of 6 to 12 feet, depending upon the porosity of the soil, is usually efficiently filtered and purified. Water entering at a less depth, is nearly always liable to be imperfectly purified and unsatisfactory in quality. The nearer the ground surface at which water can enter, the greater the danger of pollution.

It follows, therefore, that the upper 6 to 12 feet of the well should be water-tight, and that the top should be so finished off that no surface water can possibly gain access. It is also desirable that the top of the well should be brought up 6 to 12 inches above the ground surface, and covered with a proper flagstone or wood or iron cover. [Plans showing two of the simplest methods of well construction are appended.]

As no new house can be occupied without a certificate from the Sanitary Authority to the effect that the house has a sufficient supply of wholesome water, it is important that builders and others should pay particular attention to the above suggestions, and so avoid the risk of a certificate being refused.

Samples of water from existing shallow wells should be drawn for analysis; and, if found impure, action should be taken under section 3 of the Public Health (Water) Act, and a proper well insisted upon, if it could be provided within the cost stipulated in the Act. This, however, opened up another serious difficulty. Only in exceptional cases was it possible to construct properly a shallow well and fix a good pump for £8 13s. 4d.; and even the maximum expenditure (£13), which could only be enforced after getting the sanction of the Local Government Board, might not be sufficient if the well was any depth. Unfortunately, also, it rested with the Sanitary Authority to prove that the supply could be obtained at the "reasonable cost" defined by the Act; otherwise the proceedings before a Court of Summary Jurisdiction would be futile. The Local Government Board had held that, where the same owner had a number of cottages, even if they were in a row, the cost must include the laying on of the water to each; so that it was impossible, for instance, to make a man spend £20 in constructing a well for three or more houses unless the well was so near that each house could have a pump on its own premises. If the well was a little distance away, this became impracticable. This appeared to the writer to be an absurd interpretation of the Act: and in Essex it had prevented many improvements which would otherwise have been carried out.

In Dr. Thresh's opinion, there was little hope for improvement until the law was simplified. At the present time, an order for closing a well could not be procured unless the Medical Officer of Health was able to prove that the water was injurious to health; whereas it should be sufficient to prove that it was dangerous to health. "Why," asked the author, "should a sanitary authority have to appeal to a Government Department to define a 'reasonable' cost? Surely the Court of Summary Jurisdiction or the County Council could deal with such comparatively trivial matters, even if the sanitary authorities were not to be trusted." Power was required to enable authorities to sink a well in a central position, and to charge the cost on all owners within a certain radius whose tenants had not a wholesome supply. In all hamlets and villages too small for a public supply to be laid on to each house, the sanitary authorities should provide wells or protect springs in central positions, and maintain the same at the expense of the parish. This would ensure that every aggregation of houses had within a reasonable distance an available supply of wholesome water. There were large numbers of parishes without any public well of this character. Again, sanitary authorities were often remiss in not properly protecting existing public supplies. They should set builders and owners an example by causing all public wells to be properly constructed and protected.

In a contribution on "Village Water Supplies," Miss C. Cochrane drew attention to the urgent need of reform in this matter. In cases where there was a water supply, though polluted, the remedy was more or less in the hands of the sanitary authorities; but in places which were naturally waterless, it was a very different thing. Miss Cochrane instanced several villages which possessed the merest pretence only to a water supply; and she mentioned a number of schools in the Axminster and Biggleswade districts which had no supply at all. To some persons, the author said, it appeared that the only solution of the difficulty was to place the water supplies in the hands of the County Councils, and spread the working expenses over the whole county. Another alternative was to make the owners responsible. But, as regarded the schools, perhaps the simplest and most effective plan would be for the Education Department to refuse to pay any grants to those schools which were unprovided with wholesome water. If this were done, not only would the present principal source of danger to the health of the children be removed, but a stronger inducement would be offered to local authorities and owners to supply the villages at the same time that they were supplying the schools; for where the school was without water, the village was often, though not always, without it also.

Discussion.

Mr. WILLIAM FOX, M.Inst.C.E. (London), said there was only one point in reference to the paper on "Village Water Supplies," and that was a difficulty which arose in the Public Health Act. There was a clause there which required any authority, before applying to the Local Government Board for a loan, to obtain the consent of all riparian owners who might have any right in the water which was to be taken. If this consent were not obtained, the Local Government Board would not hold an inquiry. In his own practice, he knew that this had given rise to great hardship. He had a case only a few weeks ago where arrangements were made with a proprietor to take water from a stream on his land; and—he believed actually out of spite—a riparian owner lower down the stream, who had no use for the water, refused to give his consent. It seemed to him that this was a power which might be relegated to the Inspector when he visited the district to hold his inquiry. The Inspector could hear every riparian owner who so desired; and then he could decide whether any such owner had a case sufficiently strong to stop the water from being taken.

The CHAIRMAN (Professor H. Robinson) said, of course, they knew the law of the land was that an Inspector could not deal with this matter.

Dr. THRESH said he would like to make a few remarks on Miss Cochrane's paper, with reference to the duties of County Councils with regard to water supplies. In the county of Essex, the water supply question was naturally a very important one; and when certain water authorities desired last year to come and take water from there to serve London, the County Council thought that it was time to look into the matter. The first thing that they were met with was the dictum of the Clerk that they had no power to spend a single penny on making inquiries; and they were therefore at a standstill. They had nothing to go upon; and until they possessed some information, it was useless for them to attempt to do anything. For some years he had been accumulating information with regard to the county; and he offered to complete that information. The Council accepted his offer, with the result that he had published what he believed was at present the only full account of the water supply of any particular county. One thing they ought to try and secure was that County Councils should have power to employ experts, having sufficient knowledge of the subject, to prepare accounts of the water supplies of different counties, on similar lines to his own. If this were done, the County Councils would have all the information at their fingers' ends to enable them to arrive at a right conclusion as to what action they should take. In his own county, this had led to several attempted water supplies being abandoned; and it had been pointed out that there were in parts of the county quantities of water never yet touched. It was a comparatively simple matter to provide a water supply for a large town; but it was often most difficult to supply a small village community. He thought that the man who could go to a village and plan for it a good water scheme, needed to be a better engineer than one who went to any of the large county boroughs and devised supplies for them. However, his County Council had found that, though it might be impossible to provide a supply for one village, if they had power to combine a district they might furnish that area with water, no matter how thinly populated it was. The more thickly populated parts would help in a measure to pay for the thinly populated portion. This, however, could not be done until the County Councils had obtained further powers.

Mr. WILLIAM WHITAKER, F.R.S. (Croydon), remarked that when they came to consider the whole question, they must take into account the private supplies as well; and in the county of Essex these would in some cases be found to be a very large item. The County Councils ought to be helped by the Government in the matter. The Geological Survey had done something in that line, though in a very small way. In one county they published an account of the water supply from underground sources only—that was the county of Sussex. It was imperfect; but if they waited for perfection in this matter, they would never do anything. The great thing now was, not to strive for perfection in the first place, but to put forward inquiry. They had the Geological Survey, who, it was thought, would continue the work of investigating sources of underground water supply. Of course, the county boundaries were very awkward; but he thought a great advance might be made by some such collection of water statistics as Dr. Thresh had undertaken for Essex.

Sir William Preece will open the session of the Society of Arts on the 20th inst., with an address.

Mr. Maurice Fitzmaurice was last Tuesday unanimously appointed Chief Engineer and Surveyor to the London County Council, in succession to Sir Alexander Binnie. At present he is the Chief Engineer of the Assouan Nile Reservoir, under the Egyptian Government. He will take over the duties of his new position on the 1st of January next.

REGISTER OF PATENTS.

Measuring Gas, Water, &c.—Tatham, E., of Lewisham, S.E. No. 12,092; July 4, 1900.

The gas-meter constructed according to this invention is shown in figs. 1 and 2—a vertical and a transverse section. Fig. 3 is a longitudinal section of a meter for water or like fluid, or as a motor.

Fig. 1.

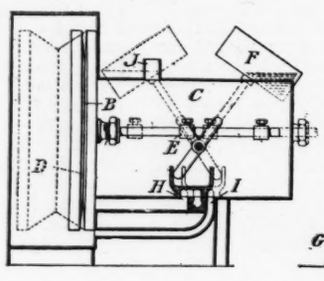


Fig. 2.

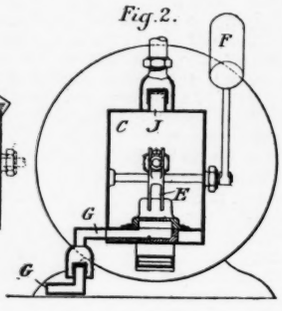
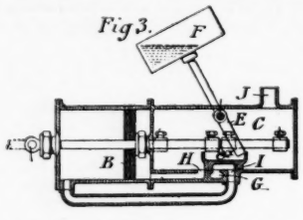


Fig. 3.



In figs. 1 and 2 there is a bellows B, to which is connected a rod passing through a stuffing-box into a chamber C, containing a valve which controls an inlet-passage and ports communicating respectively with the interior D of the bellows, and with the space outside the bellows. The valve is operated by a lever E, secured to a shaft capable of oscillating in the chamber C, and acted on by pins or projections which come into contact with the lever at or near the termination of each stroke or impulse of the bellows, so as to turn the lever slightly beyond a vertical position. The lever is then, by a rolling weight or a body of mercury in a chamber F, caused to tilt suddenly and act upon the valve with a quick movement to reverse its position.

The gas to be measured enters the chamber C by the inlet G; and, if the valve be in the position shown in fig. 1, the gas passes through the port or passage H to the interior of the bellows, and expands them. As the bellows expand, the lever E is acted upon so as to turn it; and just as the bellows completes its expansion, the lever is turned beyond its vertical position, whereupon the weight or liquid in the chamber F causes the lever to suddenly fall over, and so turn the shaft as to cause the lower end of the lever to rapidly reverse the position of the valve, from the position shown by the full lines into that shown by the dotted lines—thereby opening the communication between the inlet G and the port I. The gas will then pass through the port to the space outside the bellows, causing the bellows to collapse and force the gas from the interior, through the port H, into the valve-box C, and out, therefrom by the passage J, to the place of consumption.

In fig. 3, the water is admitted to the valve-box or chamber C by the passage J; the passage G being the exhaust or discharge port. Instead of a bellows for the fluid to act upon, there is a piston B, fitted to slide in the cylinder of the meter. The water admitted to the valve-box C is conducted by the port or passage H or I to one or other end of the cylinder, according to the position of the valve; and, acting on the piston B, drives the piston along the cylinder. The piston-rod projects from both sides of the piston through the ends of the cylinder; the one end being connected to mechanism to be operated, and the other end passing through a stuffing-box into the valve-box C, and being provided with pins or projections to act on the levers E on the shaft, for the purpose of reversing the valve in a manner similar to fig. 1.

Purifying and Treating Gases from Gas-Producers.—Crossley, W. J., of Openshaw, Manchester, and Atkinson, J., of Marple. No. 17,734; Oct. 6, 1900.

The object of this invention is the construction of apparatus "for transferring some of the heat from the gas coming from a gas-producer to the air passing into the producer; also moistening this air with water vapour, and to some extent clearing the gas from tar, dust, or other impurities. It is chiefly intended to be used in connection with gas-producers used for making gas of comparatively low calorific value."

Fig. 1 is a vertical elevation of the apparatus; fig. 2, a plan; fig. 3, a sectional elevation of two sections drawn to a larger scale; fig. 4, a plan; and fig. 5 a vertical section through four sections.

The apparatus consists of any number of sections—say, eight, as shown in fig. 1. Each alternate section is a gas section; and the intermediate sections are for air. Gas from the producer enters the top section by a pipe A, where it is brought into contact with a spray of water; or (as shown) the water may enter by a side lute B, and be distributed by means of trays E and F. The gas passes downwards successively into each alternate section, as shown by the arrows, and is led away from the bottom by a pipe A1. Communication is made between the gas sections by pipes D, passing through the intermediate air sections. The air is brought into the lowest section by a pipe C, and passes upwards through each alternate section until it is led away at the top by a pipe C1. Communication between the air sections is made in a similar manner to that between the gas sections—viz., by pipes or passages D1 through the gas sections.

The water in the highest section being brought into contact with the hot gas from the producer, is heated; takes up some of the dust, tar, or other impurities in the gas; and passes from the bottom of the highest section, through the inverted syphon G, to the top of the second section, where it comes into contact with the air already partially heated and moistened in the lower sections of the tower, and increases its heat and humidity. The water passes from the bottom of the second air section to the top of the third gas section, by means of the inverted syphon H, through which the gas from the highest section is passing,

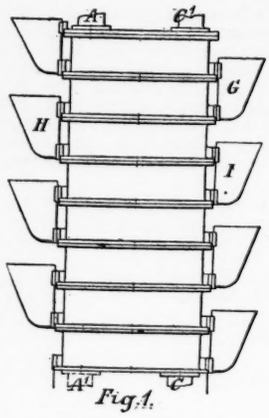


Fig. 1.

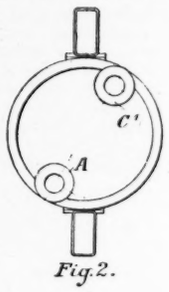


Fig. 2.

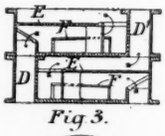


Fig. 3.

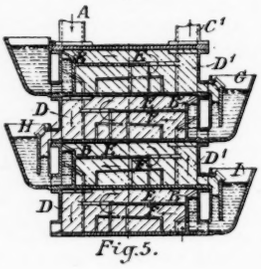


Fig. 5.

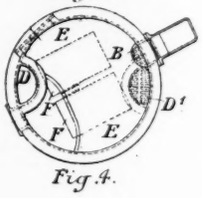


Fig. 4.

taking up more heat, more moisture, and more impurities. It goes thence into the fourth section through the inverted syphon I, and again comes into contact with the air passing upwards. This alternate action goes on through as many sections as may be desired, until the gas and unevaporated water arrive at the bottom; the gas being cooled and cleaned, and the air (which entered cool and dry at the bottom) passing out at the top heated and loaded with vapour.

The impurities extracted from the gas are partly carried away by the surplus water or deposited in the bottoms of the inverted syphons, which also form water lutes, as shown at G, H, I, in connection with each section, and from which they can be removed as desired.

Manufacture of Gas for Lighting, Heating, and Other Purposes.—Lane, H., of Birmingham. No. 17,762; Oct. 6, 1900.

This invention relates to the manufacture of gas from coal, coke, wood, or other carbonaceous or combustible substances, in conjunction with water. It is claimed that, by working as described, "volatile hydrocarbons, such as ordinary coal, as well as carbon, such as coke or anthracite coal, can be converted into a gas for industrial uses without splitting up, 'cracking,' or otherwise prejudicially affecting the volatile product."

The apparatus consists of a generator or producer, a regenerator, a system of valves, an annular air-space and passages, operating and controlling mechanism for the valves, and means for blowing air into the generator or producer, and for supplying water or steam to the regenerator.

There are shown (p. 1177) a vertical section, side elevation, and front elevation of apparatus where the generator and regenerator are separate vessels; but they may be combined in one vessel or casing.

The generator or producer consists of a vertical metal casing, thickly lined with fire-brick or other refractory material, and provided at the top with a hopper for the supply of the fuel to be converted into gas. The generator has in its walls a number (in the example, three) of air-inlet pipes and passages disposed at different points one above the other—consisting of annular spaces with openings controlled by valves and covers, and communicating by radial passages with the interior of the generator at different heights, and at different times progressively. There is also near the top of the generator an outlet passage and pipe A, controlled by a valve, for the delivery of the gas. The generator is fitted with sight and poking holes, and such fittings as are common to similar furnaces; and at its base a fireplace B is provided for the initial starting of the apparatus. At the bottom of the generator there is an outlet through which the ashes fall into an ashpan or trough, kept nearly full of water, in order to seal the outlet and keep the generator gas-tight.

The generator is connected at its base by a passage C with the base of the regenerator, consisting of a vertical metal casing thickly lined with refractory material, and partly filled with fire-brick checker-work, and partly with checker-work of iron or other material not liable to disintegrate under the action of moisture and heat. At its upper end, the regenerator is connected with a chimney D, which is opened and closed by a valve; and at some suitable point in the regenerator—preferably near the base—is an air-inlet pipe and passage E fitted with a

Fig. 1.

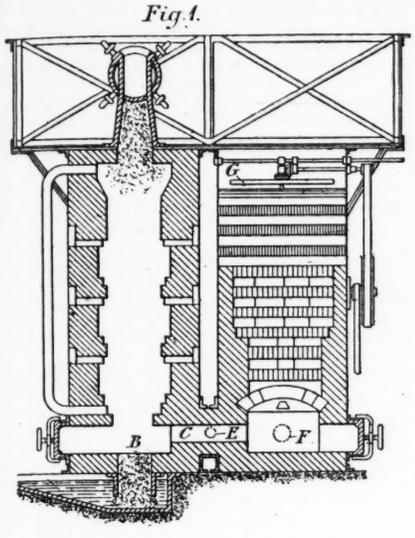


Fig. 2.

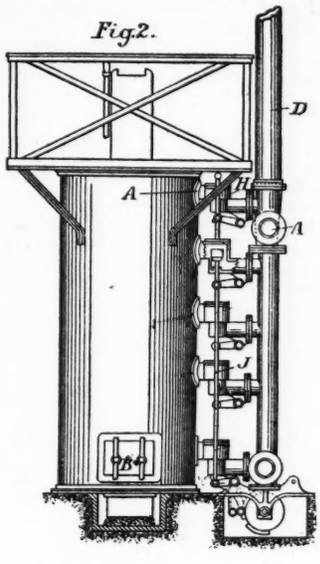
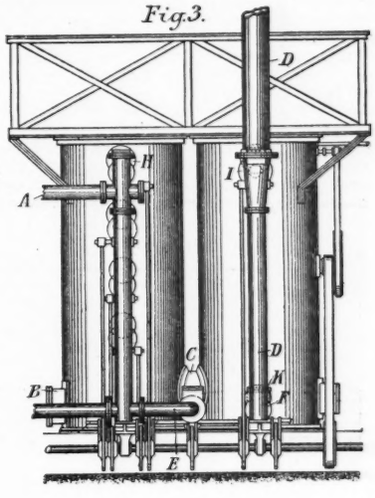


Fig. 3.



valve in a casing, and a scavenging outlet F, also fitted with a valve in a casing. The regenerator has sight-holes (not shown) for enabling its interior to be inspected, and a door for cleaning purposes.

In the regenerator, above the iron checker-work is mounted a revolving distributor G, supplied with water as required through a pipe controlled by a tap or valve, not shown. The distributor is revolved by a pair of bevel gears, shaft, belt pulley, &c., driven from a gas-engine or other motor, and having mounted on it cams for actuating the several gas and air valves in any convenient manner.

When starting the apparatus, a little fuel is fed through the hopper into the interior of the generator, and a fire is started in the fireplace B; the cleaning and poking orifices being open at the time. As the fuel burns, these are closed, and a fresh supply of fuel is gradually fed in through the hopper until the whole mass within becomes highly heated. The fresh fuel, owing to the high temperature of the generator, at once volatilizes to the extent of giving off a combustible gas, which may be allowed to pass away through the gas-outlet pipe A to a holder (not shown), whence it may be conducted to the gas-engine—if one is employed—and utilized to run the engine for a few turns while starting the apparatus. Then the gas-valve H is closed and the outlet-valve I from the regenerator to the chimney is opened; and the ordinary working of the apparatus begins. First, air is blown into the generator from a suitable fan or equivalent (not shown), connected to a pipe J. The air passes down through the mass of heated fuel, first from the highest air-inlet, and then from the next in order lower down; the valves of the inlets being opened and closed by their respective cams to bring the air-inlets progressively into action, and thereby create a series of zones of high temperature at different heights, which combine to constitute a column of incandescent fuel. During the blowing period (as described), the gaseous products of combustion pass from the generator into the lower extremity of the regenerator, and in their passage meet a supplementary supply of air admitted through the air-inlet E, whereby complete combustion is effected. After this, the gaseous products ascend up the interior of the regenerator, first through the fire-brick checker-work, and then through the iron checker-work, which absorb the heat from the products before they escape up the chimney. When the regenerator has become highly heated, the blowing period is terminated, and all the air-valves are closed, as well as the valve controlling the outlet to the chimney.

The scavenging valve K is then opened, and the tap or valve of the water supply is also opened, so that water is sprayed upon the heated iron checker-work, and is instantly converted into steam, which passes downwards through the interior of the regenerator, and, displacing the remnant of combustion products therein, scours them out through the scavenging opening F. The scavenging valve K is only opened for a very brief period; and immediately it is closed, the gas outlet-valve H of the generator is opened. The steam, now superheated, passes along the passage C, up through the column of incandescent fuel in the generator, and in so doing becomes decomposed into its constituents—hydrogen, carbonic oxide, and other gases being produced. These gases now pass up through the green or raw fuel at the top of the generator, and subject it to destructive distillation; the hydrocarbon and other vapour thereby liberated mixing with the gases and passing away with them through the gas-outlet pipe A to the holder.

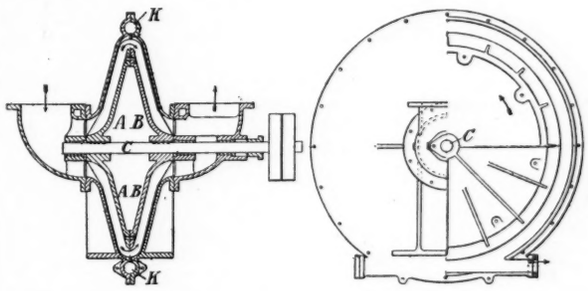
To facilitate combustion and prevent caking or clinkering of the fuel in the generator, a smoke pipe or passage L (controlled by a valve) may be employed leading from the upper to the lower part of the generator. The effect of this pipe or passage is, by providing an outlet in the upper part of the generator, to cause an up-draught of part of the blast introduced through the air-inlet passages.

On the termination of the gas-making period, the blowing period in the generator recommences. Thus water gas is first formed, and is then converted into a richer gas by its passage through, and its action upon, the green or raw fuel.

Purifying Producer and Coke-Oven Gases.—Crossley, W. J., of Openshaw, Manchester, and Atkinson, J., of Marple. No. 17,993; Oct. 10, 1900.

This invention relates to means for removing from the gas from gas-producers, blast-furnaces, coke-ovens, &c., such impurities as tar or dust, so as to make the gas more suitable for use in gas-engines or for other purposes.

The apparatus, as will be seen, consists of a rapidly-revolving body, preferably shaped like two frustra of cones A B, having their large ends placed together and axially fixed on a shaft C carried in bearings at each end. The conical surfaces of the revolving body are provided with a number of external radial ribs; their outer edges being also conical. The revolving body, with the ribs, rotates in a stationary casing, having a slight clearance between the edges of the ribs and the inner surfaces of the casing, which also is shaped like the frustra of two cones placed base to base in the part where the ribs on the revolving body rotate.



The gas is brought into one of the smaller ends of the stationary casing, and is caused to revolve by means of the ribs on the revolving body, at a moderate speed at first when near the smaller diameter, but rapidly increasing to a very high rate of speed when near the large diameter of the revolving body. It then passes to the other smaller end, from which it is delivered.

The gas usually having been in contact with cooling water, will not only be saturated, but will carry water along with it in suspension, together with tar, dust, or other impurities. When rotating at a very high rate of speed (which may be some 200 or 300 feet per second), the centrifugal force drives any impurities which are heavier than air or gas on to the surface of the casing towards the junction of the two large diameters, at which place a suitable slot is provided to allow for their escape into a passage K leading to an outlet suited to the direction of rotation.

Retort Charging and Drawing Apparatus.—Foulis, W., of Glasgow. No. 18,365; Oct. 15, 1900.

In his specification, the patentee remarks that, in drawing the charge from retorts, considerably more power is requisite for the first withdrawing stroke of the rake than for the succeeding strokes; and in apparatus as hitherto arranged for this purpose, wherein water under pressure is employed in ram-cylinders, considerable loss of power occurs in consequence of the quantity of water under pressure being equal for each of the strokes. According to the present invention, therefore, he arranges the apparatus so that the exhaust for the free escape of water can be opened for the stroke, or strokes, when most power is required; so that then the full power of the water under pressure is exerted, and at the succeeding strokes of the drawing operation, the exhaust is put in communication with the source of supply of water under pressure, so that the exhaust water is returned to it.

This can be effected by making the cylinder of the ram for withdrawing the rake of larger diameter than the cylinder of the ram for introducing the rake into the retort, and keeping the smaller cylinder normally in communication with the supply of water under pressure. Under these conditions, the effective power exerted on the ram of the withdrawing cylinder will be that due to the water pressure multiplied by the difference of the areas of the rams; and the water from the smaller cylinder will be returned to the source of supply of water under pressure. When it is required to obtain greater power in the cylinder of the withdrawing ram, the water pressure is shut off from the small cylinder during the withdrawing stroke, and communication is opened for the free escape of the water from the smaller cylinder; and then the effective force exerted on the ram of the withdrawing cylinder is that due to the water pressure on the whole area of the ram of the

cylinder. Instead of using two cylinders and rams of unequal diameter, one cylinder only may be fitted with a piston, and a large piston-rod constitute a ram with unequal areas at its opposite sides; the annular space between the piston-rod and the cylinder replacing the small cylinder already described. When this arrangement is employed, the ropes or chains for operating the rake are carried over pulleys at the end of the rake-beam, to give reciprocating motion to the rake.

According to the 1899 patent (No. 8486), it was intended to employ a three-ported slide-valve; but according to the present invention, four piston-valves are employed, these bearing against narrow valve-seats when the valves are closed. These valves are so constructed that the water pressure acts equally (or nearly so) on each side of the valves—thus enabling them to be moved with a minimum of resistance.

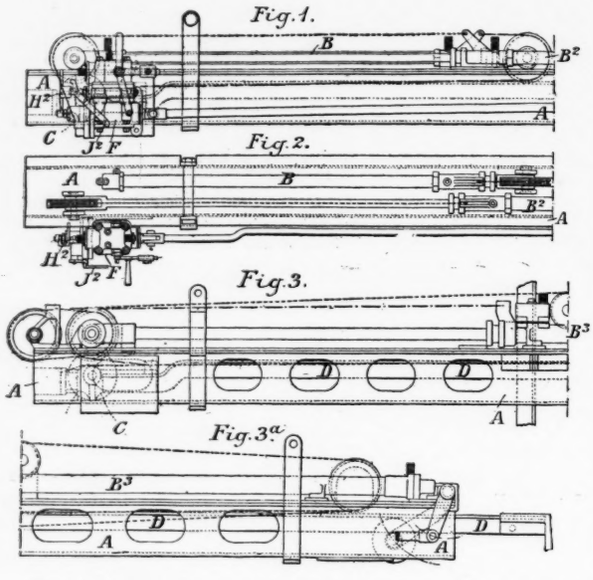


Fig. 1 represents in elevation, and fig. 2 in plan, the rear part of a portion of a retort-drawing apparatus modified according to this invention; and figs. 3 and 3A are elevations of the rear and forward parts of a modified arrangement.

A is the guide or beam, and C is the carriage described in the patent of 1899. On the guide are rigidly secured the differential hydraulic cylinders B B^2, the ram of the smaller cylinder B imparting forward movement to the rake, and that of the larger cylinder B^2 imparting backward movement to it. The hydraulic cylinder F and its ram, and the operating hand-lever, &c., are employed as in the earlier patent; but in order to control the exhaust from the smaller cylinder for the purpose already referred to, valves are employed to control the passage of water to, and from, the cylinder B, and others to operate by tappets controlling the passage of water to, and from, the cylinder B^2. These valves are of the piston type; and through each valve is a longitudinal passage by which pressure water can pass to the backs of them, so that the pressure on both sides of the valves is equal, or nearly equal, and consequently the valves can be easily moved. The valve-box is divided by a hollow partition into two compartments—one communicating with the source of pressure water, and the other communicating with an outlet, or with the pump by which the exhaust water can be pumped into the accumulator. The tappets which operate one set of valves are fast on a shaft or spindle, mounted in bearings in the valve-box; while the tappets which operate the other valves are formed on a sleeve mounted loosely on the shaft. When the ram is at the rear end of the cylinder F, the rake is raised into position to enter the retort; and when the machine is in position with the rake opposite the retort to be drawn, pressure water is allowed to enter the valve-box, and, as the valve is normally retained open by a weighted lever, pressure water will enter the cylinder B, and force its ram therealong, so that the rake is caused to enter the retort. When the rake is inserted to the desired distance in the retort, the valve is turned so as to admit pressure water into the cylinder F behind its piston, which is thereby driven forward, and the rake descends; and at the same time pressure water will pass through from the cylinder F into the cylinder behind the ram, which will be moved forward and move the tappets, so as to open the inlet-valve to admit pressure water to the cylinder B^2 and close the exhaust-valve of the cylinder. When the full pressure of the water is required to withdraw the rake, the valves of the small cylinder B are reversed, so as to cut off the supply of pressure water to, and open the exhaust passage from, the cylinder. The full pressure of the water will now act on the effective area of the ram of the large cylinder B^2, to withdraw the rake. For the succeeding strokes of the ram, or when less power is required to withdraw the rake, the exhaust-valve of the small cylinder B is allowed, by the operation of a weighted lever, to close, and at the same time the valve is opened, and kept open, so that the water which was admitted thereto to insert the rake will, when the rake is being withdrawn, return through the valve to the valve-box.

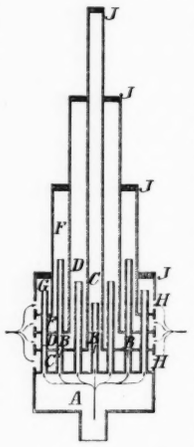
When this arrangement of valves is employed in machines for charging retorts, the connections between the valves and the hydraulic cylinders B and B^2 are reversed; and the roller or pulley supporting the rod carrying the pusher, is in its lowered position when the pusher is being inserted in the retort.

For the purpose of releasing the rake, should it become fixed in the charge in the retort, there is fitted, so as to slide in a stuffing-box in the rear end cover of the cylinder J, a rod, the outer end of which has a head on which a crank-pin can be caused to act, so as to move the rod into position to retain the ram in its forward position, and consequently maintain open the valve by which pressure water is admitted to the cylinder B^2, while pressure water is being admitted to the forward side of the piston or ram in the cylinder F, so as to cause the piston or ram to move rearwards and raise the rake out of the charge. The crank-pin is carried on a crosshead on a rod mounted so as to be capable of turning in a bracket bolted to the rear end cover of the cylinder F. On the rod is secured a lever-handle J^2, by means of which the rod and the crank-pin can be turned on the bracket into, and out of, operative position. On the lever by which the rotary valve is operated, is a crutch or segmental slotted projection H^2, which, when the lever is in position to open the valve to exhaust the cylinder F, engages the crosshead so as to prevent the crank-pin from being rotated to operate on the rod. On the bracket is a projection which controls the extent of movement of the lever-handle J^2.

Instead of employing two cylinders and rams as described—namely, one for inserting the rake, and the other for withdrawing it—only one cylinder B^3 may be employed, as shown in figs. 3 and 3A. The ram in this case presents a greater area to be acted upon by the pressure water at its front side than it does at its rear side; the side having the greater area being the equivalent of the ram in the larger cylinder B^2, and the side having the lesser area being the equivalent of the ram in the smaller cylinder B of the previously-described arrangement. To insert the rake into the retort, pressure water is admitted to the valve-box, as in the first arrangement; and the inlet-passage for the water pressure to the rear side of the ram being normally maintained open by the weighted lever, the water pressure drives the ram forward. One end of a chain connected to the cylinder B^3, after passing round a pulley mounted on the outer end of the ram, is connected at its opposite end to the carriage C, to which the rod D carrying the rake is pivoted. Another chain is connected to the carriage C; passing beneath and round a stationary pulley at the forward end of the beam A, then over a carrier pulley, and over, and round, a pulley carried on the rear end of the beam A, and thence beneath and round a pulley mounted on the outer end of the ram. By this arrangement of the chains, when the ram is forced into the cylinder B^3 by pressure water admitted to the rear side of the ram, the carriage C will be drawn forward; and the rake connected to it, and which is in its raised position, will be inserted into the retort. The pressure water is admitted to, and exhausted from, the respective ends of the cylinder by valves, as described with regard to the two-cylinder arrangement.

Gas-Burners.—Eguia, Le Comte de Casa, and Bourrelly, G, of Paris. No. 10,437; May 20, 1901.

The object of this invention is to provide a burner which, "without the aid of independent regulating apparatus, shall render the whole of the mantle incandescent whatever may be the gas pressure supplied—thereby largely increasing the illuminating power of the mantle, and producing a steady light."



As shown, the burner consists of a chamber A (into which the gas from the supply-pipe flows), provided with distributing tubes B to supply gas to the various compartments of the burner. At or near the centre of the burner is arranged a tube C, which supplies the mixture of air and gas to the upper part of the mantle. D, F, and G are tubes arranged concentrically with the tube C, and adapted to supply the mixture of air and gas to the mantle at various heights. In the outer wall of the tube G, orifices H are provided for the admission of air to the various compartments of the burner formed by the tubes or partitions C, D, F, G. J are the upper parts of the compartments, through which the gaseous mixture escapes and is ignited. Each compartment receives, independently of the others, the quantity of gas and air necessary for proper combustion. The gas arrives at A, and passes immediately through the tubes B into each of the compartments formed by the tubes C, D, F, G; but not finding any resistance, it escapes through the orifices J, having in the meantime drawn in, through the orifices H, the quantity of air which it requires for combustion.

It will thus be seen, say the patentees, that, by the use of the burner, "the whole of the mantle is caused to become incandescent, while such mantles may be made of any convenient height or size—thus enabling a light to be produced of a magnitude hitherto unattained. Further, the results obtained enable gas of very low pressure to be utilized. But the principle of the invention is to produce various steps of flame-jets of very high temperature, in such a manner that the flames all combine with one another to form a luminous cluster or pencil of any desired height."

APPLICATIONS FOR LETTERS PATENT.

21,003.—Forbes, H. A., "Controlling the supply of gas to burners." Oct. 19.

21,016.—Henlein, S., "Regulating nozzles or valves for mixing gas and air." Oct. 19.

5757A.—Hayes, A., "Production of gas or vapour for use with explosive engines and for other purposes." Oct. 20.

21,057.—Wetter, J., "Cutting incandescent mantles to a given length." A communication from M. Weickert. Oct. 21.

21,082.—Wells, A. C., "Acetylene gas-generators." Oct. 21.

21,102.—Melhuish, A. G., "Gas-engines." Oct. 21.

21,115.—Panvert, P. A., "Gas-pulsator." Oct. 21.

21,116.—Marshall, C., "Anti-vibrator for gas-burners." Oct. 21.

21,120.—Bryon, A. H., "Generating gas for motive-power purposes." Oct. 22.

21,125.—Crossley, F., "Incandescent gas-burners." Oct. 22.

21,175.—Hager, C. F. A., "Governors for explosive engines." Oct. 22.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Disclosure of Trade Secrets at Leeds.

SIR,—Our clients, Messrs. James Milne and Son, Limited, have seen Messrs. Simpson and Simpson's letter in your issue of the 29th ult.

The words used by the Recorder of Leeds in regard to Messrs. Milne, as reported in the "Yorkshire Post" of Oct. 18, were as follows: "There does not seem to be the slightest reflection upon Messrs. Milne in this transaction."

We can quite understand that, in view of the pending action against our clients by Messrs. George Bray and Co., Messrs. Simpson are much concerned at the words used by the Recorder; but, notwithstanding the ingenious way in which they have tried to divest them of all meaning, the words remain as the Recorder's opinion of Messrs. Milne's conduct. He must be given credit for having said what he meant, and meant what he said; and at any rate our clients are entitled to the benefit of this impartial opinion until an adverse verdict is found against them.

LUPTON AND FAWCETT,
Solicitors for Messrs. James Milne and Son, Limited.

Leeds, Nov. 2, 1901.

Remuneration of Labour.

SIR,—Permit me to say that I appreciate the friendly and courteous reply in this week's "JOURNAL" of the writer of the article on "The Remuneration of Labour." There is little if any difference in our views. I think he will agree with me that the practice of thrift by profit-sharers is the only tangible evidence that the system is doing them permanent good; and this is the reason why I attach importance to the matter.

GEORGE LIVESEY.

Nov. 1, 1901.

Spontaneous Ignition of Coal in Bulk.

SIR,—I was much interested in reading, in the "Notes" in the current issue of the "JOURNAL," the finding of the New South Wales Commission on the spontaneous ignition of coal in bulk. Their conclusion, that the best way to prevent coal heating is to wet it well before it is stored, and the best way to put out a fire in a coal heap is to apply water plentifully, is one with which I fully agree. I may be credited with some little knowledge of the subject, as last year I had to deal with very large quantities of coal which had fired. Holding the generally accepted opinion that water is of little or no use, I did not at first employ it, except for the purpose of quenching the burning stuff in order that the men might handle it. As matters got worse, however, I determined to do what, as far as I knew, had not been done before; and, by means of a varied assortment of pumps, I applied sufficient water to end the trouble. After that, when any portion of the heap, which contained about 30,000 tons, showed signs of heating, a liberal dose of water was applied, and no further trouble was experienced. Since then I have thoroughly wetted a cargo of coal as it was being stored; and after months there was absolutely no tendency to heat.

I should have no hesitation in treating in this manner all coal to be stored for any length of time, were it not for the injurious effect that it might have on subsequent carbonization. The fact that a limited amount of water is injurious received ample confirmation when dealing with a bad fire in a heap of about 6000 tons. At first a gas having the characteristics of water gas was formed as the water reached the seat of fire, and this, on becoming ignited, intensified the trouble; but a further supply of water produced a satisfactory result.

East Greenwich, Nov. 1, 1901. JOSEPH TYSOE.

Method of Charging Inclined Retorts.

SIR,—I have read Mr. Shoubridge's letter on the above subject in the last number of the "JOURNAL," and send you specifications, neither "funny" nor "false," showing the comparative cost of the two systems. Taking Mr. Shoubridge's system for four benches of inclined retorts, each containing thirteen beds in settings of eight, I find that material as per Specification No. 1 would be required. The cost for this would, or should, be about £6200. This is taken from the cost-account of a job actually supplied. Specification No. 2 gives particulars of the plant required for the continuous overhead hopper with "shot-pouch" measuring-chambers for each tier of retorts; and the price for this would be £5400 (again I quote from actual cost-sheets). In neither case have I reckoned on duplicate engines and elevators.

In the same issue of the "JOURNAL" as that in which Mr. Shoubridge's letter appears, I notice Mr. Hack's able description of the new inclined retort installation at Nechells, where the Shoubridge system has been adopted. On p. 1097, Mr. Hack, referring to the new retort-house at the Saltley works, states that he has "determined upon the continuous hopper arrangement in preference to the large hoppers as at Nechells; for with the latter the only advantages are more air space and saving in cost [?], against which there is the travelling of the chargers to and from the hoppers, and the complication of the chains in connection with the 'even-feed charger'—the chains being liable to be incorrectly dealt with by inexperienced hands which we have to employ now and then; the result being the dropping of coal on to the charging-floor."

I have distinct and pleasant recollections of many interviews with Mr. Shoubridge—one in particular about the application of a rope-haulage system to traverse his cumbersome three-compartment charger, the necessity for which, in my opinion, was done away with when the less expensive and more efficient arrangement with a fixed measuring-chamber over each retort was successfully applied.

Smethwick, Nov. 1, 1901. GILBERT LITTLE.

[ENCLOSURES.]

Specification No. 1 (Shoubridge System).

Two coal-crushers, four-roll type, with one hopper over each, and two shoots to feed elevators; structure to carry crushers and hoppers, and elevator pit. Two 18-inch elevators, with shoots to cross push-plate conveyors, with outlets to feed four longitudinal conveyors. Four longitudinal push-plate conveyors to fill the hoppers, complete with sliding doors. Four large hoppers to hold 24 hours' supply for the 52 beds—the size being about 23 ft. by 11 ft. 6 in. wide and 10 feet deep—with necessary sliding doors and levers; structure to carry same, similar to that shown in photographs in last week's "JOURNAL," illustrating the Saltley plant. Two engines and all necessary gearing, including belt shifting gear; all necessary gangways along conveyors, and to elevator heads; structure to carry elevator heads and push-plate conveyors With this plant there would be one elevator at either end of the building, each to supply two benches. The capacity of the two elevators combined is 36 tons per hour.

Specification No. 2 (New Conveyor Company's System).

One crusher hopper. One four-roll crusher. One shoot to elevator. Structure to carry above. One 20-inch elevator. One shoot to cross conveyor. Four longitudinal conveyors over continuous hoppers. Four continuous steel hoppers, each 143 feet long, and joists to carry same off buckstaves. Measuring chambers (156) with levers, brackets, automatic discharge regulator, &c. One engine. All necessary gearing, including belt shifters, gangways, and supports for elevator head. The capacity of the whole plant would be 40 tons per hour.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE, IRELAND—CHANCERY DIVISION.

Wednesday, Oct. 30.

(*Before the* MASTER OF THE ROLLS.)

Welsbach Incandescent Gaslight Company v. M'Grady.

This was an action for damages for the infringement by the defendant of the plaintiffs' patent relating to the manufacture of incandescent appliances for gas-burners, and for an injunction. The defences were mainly traverses, and that the invention claimed by the plaintiffs was different from that sold by the defendant.

Serjeant DODD, K.C., and Mr. H. G. JEFFERSON appeared for the plaintiffs; while Mr. HUME, K.C., and Mr. M'ILROY represented the defendant.

Mr. HUME applied for an adjournment till after the trial of an action which was pending in England for the purpose of testing the validity of the plaintiffs' patent. He said his client undertook to abide by the result of that action, and was not prepared to contest the matter further, as he was merely a vendor.

Serjeant DODD would not consent to an adjournment.

The Court then decided to hear evidence; and Counsel for the defendant retired. After evidence had been given,

His LORDSHIP delivered judgment for the plaintiffs, in terms of the prayer of the statement of claim, including an injunction and certificate of validity under the Act. He allowed the plaintiffs full costs.

The plaintiffs waived the reference of inquiry as to damages.

COURT OF SESSION—BILL CHAMBER.—Thursday, Oct. 31.

(*Before Lord* PEARSON.)

Welsbach Litigation in Scotland.

His Lordship to-day heard Counsel in an application by the Welsbach Incandescent Gaslight Company, Limited, against Stanley Hobern, carrying on business as the Incandescent Fittings Company, at No. 359A, Argyle Street, Glasgow; and also against the Incandescent Fittings Company. Interdict is asked of the infringement by the respondents of the complainers' 1893 patent. It is stated that the premises in Argyle Street were let to Harold Gurney, who carries on business as the Incandescent Fittings Company at No. 22, Farringdon Avenue, London, and also in Cardiff. Actions for infringement are at present in dependence in England against Gurney and the Manager of the Cardiff business. Hobern conducts the Glasgow business. It was formerly carried on at No. 50, Oswald Street, Glasgow, by Richard Shepherd, against whom the complainers obtained interdict in June last. The respondents maintain that the patent of 1893 was anticipated by the patent of 1886. They also say that the incandescent mantles founded on were "Guaranty" mantles. Gurney is the Manager of the Incandescent Fittings Company; but the business does not belong to him. Immediately after Shepherd was interdicted, he left the employment of the Company, without giving intimation of his intention to do so. The Fittings Company act as agents for the Guaranty Incandescent Mantle Company, of Balham Hill, London; and they sell only their "Dura" Guaranty mantles, and those of the Sunlight and Welsbach Companies—the last two being the manufacture of the complainers. The complainers, it is contended, have failed to obtain an injunction in England against the Guaranty Company; and on Oct. 15, the Lord Chief Justice refused to grant an injunction against a customer of the Company, in respect that the Company had not been interdicted.

Lord PEARSON said this was one of a long series of cases which came up from time to time; and the difficulty he felt was to disengage himself entirely from what had already been done, so as to enable him to treat this case on its own real merits, in a question of interim interdict. The sole point for him was whether the respondents should be allowed to continue to sell the alleged infringing mantles. It was said that the mantles were covered by a patent dated in 1893, but which became effective to the manufacturers only in 1897. This, of course, was a specialty, because the date of the patent was far enough back, if it had been used from that date, to create a strong presumption that the public had acquiesced in the mantle, thereby setting it up. Therefore the use from 1897 was not so long as most of the cases in that department had furnished instances of, when the question was one of

interim interdict. But it was said that, although there had been many proceedings, both there and in England, at the instance of the complainers, their difficulty had always been, not so much to vindicate their patent, as to get anybody to challenge it effectually. And, looking back over the proceedings there, he could not help having a suspicion that this was so. This experience had shown him that the complainers had done, he thought, their very utmost to get a foeman worthy of their steel. Proofs had been allowed; but nobody came up to them. And the result was that, in every case, if he remembered rightly, interdict had been declared perpetual, virtually in absence. Now, at last, it was said, they had got a substantial adversary in England, challenging the validity of their patent; and proof in those proceedings was in course of being arranged for. If it were a clear case of the manufacturer in England being challenged as an infringer in respect of the mantles he made, and of the English Courts having, on the merits of the question of interim injunction, refused such interim injunction, he should have hesitated before applying interim interdict there, against either a customer or an agent of the party in England against whom, by the assumption, interim interdict had been refused. But this was not a clear case of that sort, because it turned out that the interim injunction which was moved for against the Guaranty Company was refused by one Judge, granted by another, and was ultimately refused by the Court of Appeal, on grounds entirely special to the proceedings in that case, and not to the merits of it. There had been undue delay on the part of somebody—he supposed of the complainers; and the Court of Appeal, when the case came before them, thought that it should stand over. Therefore, the interim injunction was not granted. But for this reason, he thought it was extremely likely that it would have been an existing injunction at the present time. Then it was said that in a recent case the Lord Chief Justice had expressed an opinion adverse to the allowing of any interim injunction in a case of this sort, where the manufacturer was left out, and the proceedings were taken against a customer. The very high authority, and the very long experience, of the Lord Chief Justice in this class of cases, would make him disposed to follow most carefully any ruling which he laid down. But this action seemed to him to be taken entirely out of the remarks of the Lord Chief Justice, by the fact that the respondent Company admitted the service, and admitted that they had acted in Glasgow as the agent of the manufacturing Company, who were in England; and it was not the case figured by the Lord Chief Justice, of interdicting a customer without being able or willing to bring an infringing manufacturer into Court. The infringing manufacturer was in Court in England at the present time; and the question was whether the agent in Glasgow was to be interdicted. There was a speciality in the case which compelled him to look back on the proceedings in the previous action in that Court, and which, to his mind, was conclusive of the question of interdict, because it appeared that the Incandescent Fittings Company had a previous man in charge of their shops as they put it themselves, of the name of Richard Shepherd, against whom interdict was granted by that Court; and immediately after he was interdicted, he left the employment of the Company, without giving notice. This circumstance lent itself so nearly to the suggestions made by the complainers—that one manager after another should resign on being interdicted, in order to weary out the complainers by having a succession of interdicts—that he did not wonder that the complainers should have thought it right, in this case, to bring the Incandescent Fittings Company into Court. He did not see that he could possibly refuse the motion for interim interdict against the Incandescent Fittings Company, when it was shown that their previous Manager was in perpetual interdict against doing what he was bound to assume was the very thing which Hobern was said to have been doing. This being so, he must treat this, substantially, as an alleged second offence on the part of the Incandescent Fittings Company, and impose an interim interdict; passing the note to try the merits of what, he assumed, was a substantial question between the parties.

David M'Mann, of Aberdeen, was summoned to appear before the First Division of the Court of Session on Saturday, to answer to a charge of having continued to sell mantles infringing the 1893 patent, under the name of the Incandescent Fittings Company, in Aberdeen, after interim interdict was pronounced against him doing so, in December, 1900. It was also reported to the Court that M'Mann was interdicted in October, 1898, from selling mantles which infringed the 1886 patent; and that, having afterwards been found guilty of breach of interdict, he was sent to prison for two months. In the second case, proof was led last July, and Counsel were heard upon it the previous Saturday.

Mr. ANDERSON, when M'Mann was called, submitted a medical certificate to the effect that the accused had undergone a surgical operation, and was confined to bed.

Mr. ROBERTSON, for the complainers, admitted that to be the case.

The LORD PRESIDENT asked if M'Mann was continuing the sale of infringing mantles.

Mr. ROBERTSON said he was not; but his wife was connected with a shop which was occupied by the Brilliant Gas-Lamp Company.

The LORD PRESIDENT asked if that was a new name.

No audible answer was given.

The case was continued.

Local Authorities and the Supply of Mond Gas.—At a recent meeting of the Golcar Urban District Council, a letter was read from the Association of Urban District Councils respecting the production and supply of Mond gas. It set forth that the promoters were sanguine that they could sell the gas for purposes of power at 2d. per 1000 cubic feet, assuming that slack could be had for 6s. a ton. The Association pointed out the serious effect this competition might have on the gas-producing departments of local authorities. The Council felt that if gas could be sold at the price quoted, the general body of ratepayers would gain more in cheapness than they would lose in the depreciation of their gas-producing plant.

MISCELLANEOUS NEWS.

GAS COMPANIES' PROTECTION ASSOCIATION.

Review of the Work of the Year—The Advantage of the Organization to Small Companies.

The Fourth Annual General Meeting of the Association was held last Thursday, at the Westminster Palace Hotel, S.W.—Mr. GEORGE LIVESEY presiding. The following representatives were also present: Mr. T. Berridge, Mr. C. E. Botley, Mr. H. B. Chamberlain, Mr. G. Clarry, Mr. H. D. Duesbury, Mr. H. Hart, Mr. J. W. Helps, Mr. H. E. Jones, Mr. William King, Colonel Makins, Mr. C. M. Ohren, Mr. R. O. Paterson, Mr. S. Y. Shoubridge, and Mr. A. G. Snelgrove.

The SECRETARY (Mr. F. E. Cooper) read the minutes of the last meeting, and also the following report on the past year's proceedings:—

The Association has, during the past year, closely watched all matters affecting the interests of Gas Companies. The principal matters to which its attention has been directed this year are those of electrolysis and arsenic in coke.

As regards the question of electrolysis, a meeting of the Committee was held to consider the question; and it was decided to ask the President of the Board of Trade to receive a deputation from the Association upon the matter. This Mr. Gerald Balfour consented to do; and the deputation was received on the 1st of April. The deputation was formed of the following gentlemen: Mr. George Livesey, of the South Metropolitan Gas Company; Colonel Makins, of the Gaslight and Coke Company; Mr. Walter Hunter, of the Commercial Gas Company; Mr. W. King, of the Liverpool United Gas Company; Mr. G. Clarry, of the Cardiff Gaslight and Coke Company; Mr. Crowther Smith, of the Southampton Gas Company; Professor Perry, Electrical Expert; Mr. C. C. Carpenter, Chief Engineer to the South Metropolitan Gas Company; and Mr. F. E. Cooper, Secretary to the Association. The President of the Association, Mr. H. Kimber, M.P., kindly introduced the deputation to the Board of Trade. At the request of the President of the Board of Trade, the proceedings were treated as of a private and confidential nature.

The Secretary had several interviews with the Secretary to the Royal Commission on Arsenical Poisoning, with reference to the allegations made by some of the witnesses before the Commission as to the presence in coke of arsenic in large quantities, and arranged, if necessary, that the Association should give evidence with reference thereto. He obtained analyses of coke supplied by various Gas Companies; and it was then decided to ask Dr. Stevenson to give evidence before the Commission on behalf of the Association, when it was found that Dr. Stevenson had devoted considerable attention to this question, and had prepared himself to deal therewith in his evidence. Under these circumstances, the Committee did not consider it necessary to proceed further in the matter.

At the instance of the Association, Mr. H. Kimber, M.P., blocked the Borough Funds Act (Amendment) Bill, and the Borough Funds Act (1872) Amendment (London) Bill; and consequently the Bills have not been proceeded with this session.

Application was made by the Association for permission for the Chairman to give evidence before the Committee on Steam-Engines (Persons in Charge) Bill. The Committee considered the application, and subsequently wrote the Secretary that, as the Employers Parliamentary Council had suggested that Mr. Livesey, Mr. Shepherd, and Mr. Lake should give evidence on their behalf, and the limited time at their disposal would only permit of their calling one of these gentlemen, it was ultimately decided that Mr. Shepherd should give evidence.

Numerous applications have been made by members of the Association to the Secretary for advice and information on many matters affecting Gas Companies' interests. As an instance of the work done by the Secretary, and the utility of the Association to Gas Companies generally, some of the matters upon which he has given advice and assistance may be mentioned: (1) Dispute with Surveyor of Taxes as to the deduction of law costs before arriving at the amount upon which income-tax should be calculated. (2) Amount to be deducted for depreciation of gasholders for income-tax purposes. (3) Disputes with Local Authorities: (*a*) As to cost of removal of gas-lamps where the supply of gas for public lighting is discontinued. (*b*) As to how the costs of lighting of streets not repairable by the local authority should be borne. (*c*) As to the alteration of gas-mains by local authority for tramway purposes. (4) Destruction of gas-meters by fire. (5) Questions arising between gas companies and electric lighting companies. (6) Payment of stamp duty by gas companies by reason of consolidation of capital. (7) Sale of disused plant. (8) Dispute as to coke contracts, arising out of the recent scare as to arsenic. (9) Questions as to recovery of gas-rents in arrear: (*a*) From trustee in bankruptcy. (*b*) From bankrupt.

These are some of the principal matters upon which the Secretary has been consulted, and, in addition thereto, may be mentioned considerable correspondence between him and the secretaries or managers of gas companies with reference to electrolysis, arsenic, the Mond Gas Bill, powers to be sought by gas companies in Acts of Parliament, and many other matters.

During the past year, eight Gas Companies have either withdrawn, or intimated their intention to withdraw, from the Association at the expiration of the current year. As regards some of these Companies, their reason for withdrawal was that their undertakings had been acquired by local authorities. Others have given no explanation as to why they have resolved to cease their membership.

Eight new Companies have joined during the past year.

In accordance with Rule 9, the following gentlemen retire from the Committee: Mr. F. W. Cotton, of the Alliance and Dublin Consumers' Gas Company; Colonel Makins, of the Gaslight and Coke Company; Mr. S. Y. Shoubridge, of the Crystal Palace District Gas Company; Mr. C. C. Smith, of the Southampton Gaslight and Coke Company; Mr. A. G. Snelgrove, of the West Ham Gas Company; and Mr. Hanbury Thomas, of the Sheffield United Gas Company—all of whom offer themselves for re-election.

The Secretary has received notice from Mr. Berridge of his intention to propose Mr. W. R. Cooper, of the Banbury Gas Company, as a member of the Committee.

The CHAIRMAN said it became his duty to move the adoption of the report, which, he thought, gave evidence of the necessity and usefulness of the Association. The first question dealt with in it was that of electrolysis. The Metropolitan Gas Companies first took the matter up, and were ably assisted by the Association. The deputation to the Board of Trade, to which reference was made in the report, was a joint one of the representatives of the Metropolitan Gas Companies and of the Association. He might say the London Companies had incurred

considerable expense over this question—the costs having amounted to between £2700 and £2800, which sum the three London Gas Companies had borne between them. He was bound to say the deputation were received by the Board of Trade in a most courteous and friendly manner. There was no disposition whatever on their part to shirk the question, or to treat the gas companies as though they were crying out before they were hurt. But the difficulty which confronted the officials of the Board of Trade was that the companies had no evidence to prove that damage to gas-mains resulted where the Board of Trade regulations were in force. It was a very difficult matter to obtain evidence. In the first place, they did not know where to search for it; and it took a considerable time before the mains became seriously damaged. The electrical experts consulted had given a great deal of information; but they had also clearly shown the companies that it was impossible to indicate precisely the positions where electrolysis was likely to happen. Beyond their having found that considerable currents passed along the gas-mains, they had not hitherto discovered any definite case which could be brought before the Board of Trade with any probability of a satisfactory result. There was one case in Liverpool which Mr. William King found. The electricians investigated it; and the companies were told that there was no doubt it was a genuine case of electrolysis produced by the current from the electric tramway. The evidence was brought before Parliament on a Water Company's petition; but the Company failed to get the protection they sought. On this question let him say that those who had taken this matter up were most anxious that their friends in all parts of the country where electric tramways were in existence should be on the look-out for cases where their mains were injured by return currents, and, when they found such cases, that they should leave them undisturbed, and not cut the pipes out and send them here, there, or anywhere else. All that should be done was simply to give information, because the experts who had been advising them, Professors Perry and Ayrton (of whose ability and earnestness in pursuing this question he must speak in the highest terms), were emphatic on this point, that an investigation should be made *in situ* in regard to the question of the current passing; whereas if the main was cut out and disturbed, it could not be accepted as good evidence of the mischief that was being done, or the cause of it. Therefore he repeated that, if any of their friends in any part of the country, found that damage was being done to their pipes—that they were being eaten away—then a report should be made at once to the Secretary of the Association, in order that an investigation might take place on the spot, to ascertain whether electrical currents were the cause, so that, if it were so, it could be brought before the Board of Trade. He was satisfied the Board were disposed to do what was right in the matter. Last session Parliament would not deal with it. They said it was in the hands of the Board of Trade, and they therefore preferred to leave it untouched. It would not be out of place to refer here to an important statement which was made at the Glasgow Engineering Congress. Dr. Leybold, of Hamburg, read a paper before the Gas Section on the destruction of gas-pipes by electricity; and Mr. Gisbert Kapp made a very capable speech on the subject. It would be found published in the "JOURNAL OF GAS LIGHTING,"* and would be included in the report of the proceedings which was going to be printed in book form. Mr. Kapp gave a very detailed and instructive account of the method adopted for preventing the escape of currents in Germany. They had not got there what were understood here as insulated return conductors. The danger was that the currents, if allowed to travel back by the rails, left them—the rails not being in electrical continuity with each other. The method adopted in Germany was to attach the rails by cables, so that at any rate it would make it so much easier for the electric current to travel back by that way than by any other. But it has not an easy course along the rails without these aids. However, they had not come up to Germany yet in this respect. Still the result of what they had done so far was to show the Board of Trade that this was a very serious matter, and that the responsibility now rested with them to see that gas and water pipes were protected from damage by these return currents. The London Water Companies had, at their own expense, joined the Gas Companies in this struggle for protection; and it had, he expected, cost them a good deal, as it had the Gas Companies. They were all alive to the danger, and intended to take every opportunity of protecting their mains and pipes—and not only their mains and pipes, but the public as well, because the loss would ultimately fall upon them, and the danger from escapes and explosions would certainly fall upon them. The next matter dealt with in the report was the question of arsenical poisoning. The Committee had meetings on the subject more than once, and took up the matter. He (the Chairman) was deputed to see Dr. Stevenson, the Professor of Chemistry at Guy's Hospital and Government Analyst in poisoning cases. He found that Dr. Stevenson had already been engaged by the brewers to investigate the matter, and to give evidence before the Royal Commission, so that he could not act for the gas companies. He (the Chairman) also found that everything that gas companies could wish should be done was being done. The coke was being analyzed from different places in the most careful and thorough manner, and evidence as to the results was being put before the Royal Commission—in fact, there was simply nothing for the gas companies to do. If the Royal Commission decided that even the minutest trace of arsenic could not be allowed in beer, the gas companies were simply helpless—the brewers would not buy malt that contained a trace, and the maltsters would not buy coke that contained a trace. Then as to other matters named. The Borough Funds Act (Amendment) Bills were blocked; and all mischief from that source had been stopped for the present. There was another Bill before Parliament with which the Committee dealt—the Steam-Engines (Persons in Charge) Bill. He (the Chairman) believed it related both to steam-engines and boilers. It had been one of the stock subjects before Parliament for a good many years, and was promoted, he believed, by certain Socialistic trade unionists who wanted to get the monopoly of this employment, so that no man should be engaged to drive an engine or tend a boiler unless he could pass an examination. According to some people, the examination would test a man's intellectual ability. An examination would mean that he would have to answer certain questions as to the construction of engines; but no examination would show whether he possessed the moral qualities—the necessary character, steadiness, sobriety, presence of mind, and so on—which he (the Chairman) thought were even more essential than a little technical knowledge. However, the Committee made application to be heard on this measure; and he made a personal application as well. He received a letter from the Secretary to say that he imagined the evidence he (Mr. Livesey) would give would be largely on the same lines as that of Mr. Restler, the Engineer of the Southwark and Vauxhall Water Company. He replied that it would be much on the same lines, but perhaps a little stronger on some points. He indicated what these points were, and then said that gas companies asked for exemption from the operation of the Bill—railways and certain other industries being exempt. He added that the fact that it was said Mr. Restler's evidence was sufficient, led him to presume that it was good and sufficient evidence on this point, and therefore that the Committee would give gas companies the protection they required. In the end, the Committee not only did this, but they went even further. They said the Bill was absolutely unnecessary. Regarding next the question of income-tax—which was a very important matter, and concerning which inquiries had been made of the Secretary—there was a letter in the "JOURNAL" only a week or two ago, suggesting that the Association should take up a test case to ascertain by law what should be the allowance for depreciation. Now, in the case of gas companies generally, they had no depreciation fund. Their plant was maintained in an efficient state out of revenue year by year. The writer of the letter saw that. He said that in small companies it was quite true that they maintained certain portions of the apparatus year by year, but the renewal of a bench of retorts—the settings altogether—or a gasholder would be a very expensive thing to charge to revenue in one year. He (the Chairman) did not quite agree with the writer as to the retorts; he thought it would be a very simple matter to spread the cost over two or three years by a suspense account, if by no other means. In regard to gasholders, however, the authorities had allowed that many years ago. On behalf of the South Metropolitan Gas Company, he himself saw the authorities at Somerset House, and pointed out to them that the life of a gasholder might be taken at 40 years, during the whole of which time it cost little or nothing for maintenance. Then it was worn out, and the whole cost had to be replaced. He asked the authorities to allow a certain percentage on the gasholders, and they said they would rather allow it in a lump sum when the holders were worn out. This had been the course adopted by the South Metropolitan Gas Company during the last twenty years or more. In that time, they had had a good many small holders to take out; and when this had occurred, they had adopted the estimate of £15 per 1000 cubic feet, and the authorities had allowed it. Then, in other cases a percentage had been allowed. At Southampton, for instance, he believed they calculated that 2 per cent. would do it in 40 years, and that was allowed. He doubted very much whether it would be worth while to attempt to get anything further. Then, as to the repair and maintenance of the rest of the plant, if a company could not bear it in one year, they could spread it over two or three years. But the income-tax people were very sharp in looking after every little thing. For instance, the Crystal Palace District Gas Company had a superannuation fund for their workmen; but the Company had not contributed what they ought to have done in past years, and the fund dropped into a rather bad state. Recently they had a very good half year; and they carried £1000 to the fund. The income-tax surveyor found this out, and claimed the tax on the £1000. The Directors refused to assent to his claim. An account was sent in, but it was paid less the £50; and the Company had heard no more about it—the cheque was accepted less the £50. The Directors thought this was right; and the income-tax people evidently saw that what had been done was that they had merely paid to the fund amounts that had been due in past years. It did not do to agree to everything that these people claimed. He thought the statement made by the Secretary as to the applications to him for advice and information proved the advantage of the Association. There were now about eighty companies members; and he thought it was a little bit hard on the eighty that others did not join them, because he was satisfied they were doing a most useful and necessary work for the whole gas industry. It was absolutely necessary nowadays, when all sorts of schemes were brought forward in Parliament, for someone to be on the constant watch on behalf of the gas industry, and to give warning of danger. It was done in the case of other great concerns. The Railway Companies had their Association, the Water Companies theirs, and the Municipal Corporations theirs; and it was essential that the Gas Companies should have one too. The Association were in a prosperous condition as to funds. The Committee had only just decided that another £200 should be invested; and this would give them £500 in Consols. But there might be an occasion when they would have to fight an action; and £500 would go a very little way towards that. At any rate, they did feel they had a right to ask gas companies generally to become members. It was not so much for the money as for the moral support they would give the Committee, and the assurance that the whole gas industry was united for its own protection.

Mr. H. E. JONES seconded the motion.

The statement of accounts was next read by the Secretary; and the motion for the adoption of the report having been extended by their inclusion, it was unanimously carried.

The CHAIRMAN then read the names of the gentlemen who retired by rotation from the Committee [see report] but who were eligible for re-election. Referring to the notice received from Mr. T. Berridge (Leamington) of his intention to propose Mr. W. R. Cooper as a member of the Committee, the Chairman said he knew Mr. Cooper very well, and he would be an eligible member; but as none of the other equally eligible members had signified their intention to retire, it happened that there were only six vacancies and seven candidates. Perhaps Mr. Berridge would say why he had proposed Mr. Cooper, and then they would be in a better position to vote.

Mr. BERRIDGE said that, after hearing the very able speech of the Chairman and the report of the Committee on the proceedings of the Association during last year, he withdrew Mr. Cooper's name. His object in putting it forward was this, that he found in the Midland

*See "JOURNAL" for Sept. 10, p. 633.

districts that many of the small companies were under the impression that the Association was intended entirely for the larger companies, and chiefly those in London and the neighbourhood. He himself knew that this was not so, and the report made it amply clear. He remembered that at the last meeting the members were asked to canvass for new members. He had canvassed the Midland companies; and he heard that one (that at Nuneaton) would join. On the other hand, he found that Warwick had actually decided to leave the Association on the ground that they thought it was for the bigger companies. He (Mr. Berridge) pointed out to them that in fighting the arsenic and electrolysis questions, the Association were doing a great service to all gas companies, and that the London Companies were really bearing the brunt of the fight. He only nominated Mr. Cooper so that, if any of the members wished to retire, they would be in order in electing a representative of one of the smaller companies; but now, with the Chairman's permission, he would propose that the six retiring members be re-elected. The report was very satisfactory. He really thought they could almost ask the corporations to join them in bearing part of the expense the Association were put to in fighting the electrolysis and arsenic questions, because they were doing good both for the municipal and company undertakings. In regard to income-tax, at Leamington they were allowed as depreciation on gasholders a lump sum, amounting to about 2 per cent. on the cost.

Alderman HART (Canterbury), in seconding the motion, spoke of the gratitude of the members to the Chairman and those who acted with him for the strenuous manner in which they had worked for gas companies generally during past years.

The CHAIRMAN said he should like to say, before putting the resolution, that, in selecting the Committee in the first instance, they had endeavoured to get members representing different parts of the country. As to Mr. Berridge's statement, that there was an impression abroad that the Association was not so much for small companies as for larger ones, he (the Chairman) should like this to go forth, that it was far more for the benefit of small companies than the larger ones. The large ones were able to take care of themselves; but the advantage which they found in the Association was that it was a sort of watch-dog. Their Secretary had to keep an eye on all the Bills that were introduced, and give a warning. But for small companies, he did a good deal more than that. They often wanted information and advice; and by writing to him they could get it. The Association was essentially for the benefit of small companies; and if ever there was a vacancy on the Committee, there was no man he should be more pleased to see elected than Mr. Cooper.

The motion was unanimously agreed to.

A conversation (initiated by Mr. H. E. Jones) followed as to the amount of the annual subscription; but the general feeling appeared to be that, at this stage, the present minimum of two guineas was not excessive for the benefits which even small undertakings derived from the work of the Association.

On the motion of Mr. A. G. SNELGROVE (West Ham), seconded by Mr. G. CLARRY (Cardiff), a cordial vote of thanks was passed to the Chairman for presiding and for his work for the Association.

The CHAIRMAN, in responding, said another debt to those which he already owed to his brethren had been imposed upon him by this very kind vote of thanks. It was one more instance of the great kindness and consideration he had received all his life; and he thanked them most heartily for it.

This concluded the proceedings.

WAGES OF LEEDS CORPORATION GAS MEN.

Concessions by the Gas Committee Rejected.

Several classes of men employed at the Leeds Corporation Gas-Works recently asked for an advance of 6d. per shift; and the Gas Committee have since given the matter their earnest and serious attention. They have not, however, succeeded in satisfying the men, although the concessions which they have expressed their willingness to grant would cost them about £1000 a year. This certainly is a proof of their desire to meet the workmen's wishes, and to continue friendly relations with them. During their investigation of the matter, a Sub-Committee visited the works in order to ascertain the exact conditions under which labour is carried on; and they also went to Birmingham, Nottingham, and Leicester, to make themselves acquainted with the circumstances of employment there. The Sub-Committee's report was adopted by the full Committee; and the proposals were forwarded to the officials of the Gas-Workers' Union. The following are the concessions which the Committee agreed to grant:—

(1) The wages of stokers to be increased from 5s. 2d. to 5s. 8d. per shift, on condition that they carbonize 70 cwt. of coal per shift in 24 mouthpieces; and they will not be required to wheel out the coke.

(2) Special coke-wheelers to be appointed at the wages of 4s. 9d. per shift, each man to wheel the surplus coke from three stokers to outside the retort house, quench, and throw up the coke.

(3) Firemen to have their wages advanced from 5s. 2d. to 5s. 4d. per shift, the work to remain as at present.

(4) The wages of coal-wheelers to be increased from 4s. 2d. to 4s. 6d. per shift, the work to remain as at present.

(5) Machine attendants to have their wages increased from 5s. 2d. to 5s. 6d. per shift, on condition that they attend to 50 retorts instead of 47 as hitherto.

(6) The wages of the drawers in the inclined retort-house to be increased from 5s. 2d. to 5s. 6d.

A meeting of the men was held on Thursday to consider the proposals; but the terms were not acceptable, and a resolution was arrived at to again approach the Committee. The point on which the keenest dissatisfaction was felt was the proposal to grant the increase of 6d. to the stokers on condition that they carbonized 70 cwt. of coal per shift in 24 mouthpieces, instead of 60 cwt. While recognizing the relief that is to be afforded to them in not being required to wheel out the coke, the men think that too much is asked from them to compensate for any such concession. Their feeling is that not only will they be called upon to work long periods in front of the retorts, but that such an increase of work may lead to a diminution in the number of hands employed, inasmuch as, under the proposed conditions, six men may accomplish what is at present the task of seven. The engagement of special men to wheel away the coke they do not look upon with much favour, as they say the stokers regard the coke-wheeling as a welcome respite from more arduous work. On the other hand, if special coke-wheelers are appointed, as proposed by the Committee, it is clear that the number of men employed in the gas-works yards would, as a matter of fact, be greater than at present. The feeling of the meeting was that the advance of wages should be given without a request for more work; and it was agreed to take the earliest opportunity of laying the ideas of the men before the Committee with the view of a settlement being arrived at. On both sides there exists a strong desire to settle the question amicably; and there is good reason to believe this will be done. A ballot of the men has been taken by their leaders; but, at the close of the report of the meeting, the ominous statement was made that, "lest any unnecessary feeling might be aroused by the declaration of the ballot of the men that has been taken, its result, on the advice of the Secretaries (Mr. J. E. Smith and Mr. W. Wood) was not made known." Of course, nothing further can be done in the matter until after the meeting of the newly constituted Council on Nov. 9.

GAS COMPANIES' COMBINATION AT SWINDON.

The prospect for the amalgamation of the undertakings of the New Swindon Gas Company and the Swindon Gas and Coke Company, which has been under consideration for several years (see *ante*, p. 1046), seems now in a fair way of achievement; the shareholders of both undertakings having approved the purchase of the latter by the former Company. An agreement has been drawn up by which, to put it in a dozen words, the New Swindon Company will buy out the other at par value. The agreement is to take effect as from July 1, 1902; and the purchasing Company will pay all the debts of the vendors up to that date. For each £10 share, of original capital, carrying 10 per cent., the shareholders of the Gas and Coke Company will receive £20 consolidated ordinary stock, paying 5 per cent. dividend, in the purchasing Company. On the additional capital, in respect of which they can pay 7 per cent., they will receive £14 ordinary stock, paying 5 per cent., in the purchasing Company. This simply means purchase at par. There is an arrangement by which, if the New Swindon Company dispense with the services of the Secretary and Manager (Mr. H. C. Shepherd) of the Gas and Coke Company, he is to be paid £400 for loss of office; and there is also a clause under which the Directors of the vendors are to receive £120 as compensation. The old Company are to carry on their business in the ordinary way until June 30, 1902; and the new Company contract to pay to the shareholders their dividends at the usual rate up to the same date, which is 9 per cent. on the ordinary stock and £6 6s. on the original stock, both free of income-tax. Three Directors of the vendor Company will join the directorate of the new Company. There is a clause for the promotion of a Bill in Parliament to give effect to this agreement, which is conditional on the approval of the shareholders and parliamentary powers being obtained. It may be stated that the capital of the New Swindon Company consists of £17,000 of 10 per cent. original stock, £27,366 of 5 per cent, and £12,600 of 4½ per cent. stock, with £3034 premiums, and £15,000 debentures. To this there has to be added £17,000 for the doubling of the original capital; making in all £92,000. The capital of the Gas and Coke Company is £31,220—something like one-third of that of the purchasing Company.

Meetings of the shareholders of the two Companies have been held for the purpose of considering the amalgamation and the terms under which it is proposed to carry it out. At the meeting of the purchasing Company, the shareholders were absolutely unanimous; there being a consensus of opinion that the amalgamation would work to the advantage of both Companies, by decreasing the cost of management, and enabling the holders of gas shares to more effectively combat the electric light scheme with which the town is threatened. The Directors were empowered to carry out the amalgamation on the terms indicated. The meeting of the vendor Company was not so unanimous, though the difference of opinion arose less in regard to amalgamation than to the question whether the shareholders should have further information on the subject before voting. It was pointed out that if an adjournment took place the scheme would have to stand over indefinitely; and the Chairman assured the shareholders that, if anything, they were having the best of the deal. Eventually, after some discussion, the scheme of amalgamation was approved with only one dissentient.

HECKMONDWIKE GAS-WORKS EXTENSIONS.

On Monday last week, the new installation of inclined retorts and coal and coke handling plant which has been erected at the Heckmondwike Gas-Works by Messrs. R. Dempster and Sons, of Elland, was formally opened, in the presence of the Chairman (Mr. Joseph Stead) and several Directors of the Company, the Manager (Mr. A. F. Goodson) the Contractors' Managing Director (Mr. J. W. Broadhead), and the Managers of some neighbouring gas-works, including Mr. Charles Wood, of Bradford. Mr. Broadhead having presented Mr. Stead with a gold key, the latter gentleman opened the door of the new building, and expressed the hope that the event would be an augury of prosperity both to Messrs. Dempster and to the Gas Company. He afterwards started the engine which drives the coal-handling plant; and then the party inspected the whole of the automatic stoking machinery. In the afternoon, they were entertained at the George Hotel by Messrs. Dempster—Mr. Stead presiding. In responding to the toast of "The Heckmondwike Gas Company," proposed by Mr. Wood, Mr. Stead gave a sketch of the history of the Company; introducing it by a brief reference to the negotiations which had taken place between the District Councils of Heckmondwike and Liversedge for the

acquisition of the undertaking. He said the Company would have been quite willing to accept a fair, reasonable amount; and if the District Councils had approached them in the spirit they desired, they would have been glad to see the town possessed of the works. He went on to say that it was as the result of a meeting in the house where they were assembled, that the Company was formed 58 years ago—on Nov. 8, 1843. He need not say that it was a small affair, and that for several years it paid only small dividends. The price paid for coal at that day would make glad the hearts of gas managers of the present time. He found that the Company purchased a quantity at 5s. 3d. per ton. It was just over ten years since the Directors placed him in the chair. The gas sold in that year (1891) was a little more than 61 million cubic feet; the coal used was 8969, or (say) 9000 tons. The gas sold in 1899 was nearly 85 millions, and the coal used was 9242 tons—only 273 tons more for an increased sale of 24 millions; showing the great advance that had been made in the make of gas and in the reduction of leakage. He might add that the increase had been going on steadily year by year during the last ten years, with only one exception, and this notwithstanding that electric lighting had been adopted in several large establishments. The increase last year (1900) was over 5 millions; and so far this year it was still going on, although the population had not increased. During last winter, it was found absolutely necessary to make extensions; and the Manager recommended an installation of inclined retorts. The Directors visited several places, and consulted various engineers, who confirmed Mr. Goodson's recommendation; and the order was given to Messrs. Robert Dempster and Sons. When the installation was fully completed, it would be, for its size, one of the most modern and up-to-date plants in Yorkshire, if not in England. In going to so large an outlay, the Company determined to have a plant second to none, so as to enable gas to be made in the best and cheapest manner; and they were assured by eminent engineers that the outlay would pay good interest. They had therefore started the works that day with full assurance of successful results. Their next outlay would be for storage. In conclusion, he said he must congratulate Messrs. Dempster on the way in which they had carried out their contract. Alderman Audsley proposed "The Manager of the Gas-Works," and expressed the hope that Mr. Goodson would be long with the Company, and see the undertaking continue its successful career. Mr. Goodson responded; and the Chairman added that they highly appreciated their Manager's services, and recognized the interest he showed on behalf of the workmen. He then proposed the health of the Contractors, coupled with the name of Mr. Broadhead, who, in responding, said the firm had received every help both from the Directors and from Mr. Goodson. He also referred to the services of Mr. Heald, who had superintended the work for the firm. Seeing that it was only eight months since they received the order, he thought they had established a record. The health of Mr. Heald was afterwards drunk, and the proceedings closed.

SALES OF SHARES AND STOCK.

At the Auction Mart, Tokenhouse Yard, E.C., on Monday last week, Mr. Alfred Richards conducted a sale of stocks and shares in various gas undertakings. The first lots offered consisted of 4 per cent. perpetual debenture stock of the Tottenham and Edmonton Gas Company, which were sold at £105 and £106 per cent. Some consolidated "A" stock of the Company, entitled to 5½ per cent. dividend, fetched £129 10s., and some "B" stock (4 per cent.) £98 and £98 10s., per £100 of stock. The 4 per cent. stock will yield the investor £3 16s. per cent.; and the "A" and "B" stocks, £4 4s. 11d. and £4 1s. 5d. per cent. respectively. By order of the Directors, Mr. Richards next invited biddings for 2000 ordinary £10 shares in the Alliance and Dublin Consumers' Gas Company, ranking for a standard dividend of 7 per cent., subject to the sliding-scale; the dividends on similar shares having been at the rate of 7½ per cent. per annum since 1884. This item in the programme for the day presented the unusual feature of the entire issue being disposed of at one price—£13 per share, returning the purchaser £5 15s. 4d. per cent. on his investment. Another new issue was by the Directors of the Redhill Gas Company, who offered £5000 of ordinary "B" stock, ranking for a 5 per cent. dividend, and entitled, in view of the last dividend paid on the original capital of the Company and the present price of gas, to 4¾ per cent. This was another remarkable item, for, with the exception of one £100 lot, which fetched £101, the whole of the stock was sold at par. A few original £10 shares in the Waltham Abbey and Cheshunt Gas Company (last dividend 8 per cent.) were sold for £16 10s. each, returning £4 17s. per cent. A single lot, consisting of £100 of 10 per cent. stock of the Worthing Gas Company, fetched £195 10s., yielding £5 2s. 3d. per cent. The remaining lots comprised stock and shares in the Colney Hatch Gas Company. Some 4 per cent. perpetual debenture stock was disposed of at £103; some £10 preference shares (5 per cent.) fetched £12 5s. each; some original shares of similar nominal amount, but carrying 10 per cent. dividend, £21 apiece; and 38 additional £10 shares, entitled to 7 per cent., £14 each. These purchases will yield £3 17s. 8d., £4 1s. 8d., £4 15s. 3d, and £5 respectively. On the previous day, Mr. Alonzo Dawes sold some original £10 shares in the Clevedon Water Company at prices ranging from £14 10s to £16 5s.; a few shares on which £7 10s. had been paid fetching £12 5s. each. At the Castle Hotel, Windsor, last Wednesday, Messrs. Buckland and Sons sold two original shares in the Windsor Royal Gas Company for £81, and four new shares for £120.

The Directors of the Goring and Streatley District Gas and Water Company, Limited, announce that on and after the 1st of January next the price of gas to ordinary consumers will be reduced from 5s. 3d. to 5s. per 1000 cubic feet, and that there will be a further reduction to 4s. 9d., for cooking, heating, and motive power, on the 1st of July. All services and meters are laid and fixed free of cost when the distance does not exceed 50 feet. Cookers and heaters are supplied on the hire-purchase system, and a liberal discount is allowed for cash.

GAS v. ELECTRIC LIGHTING FOR LIVERPOOL STREETS.

At the Meeting of the Liverpool City Council last Wednesday, the Electric Lighting and Power Committee presented a report by the City Lighting Engineer (Mr. C. R. Bellamy) as to the lighting, among other thoroughfares, of Renshaw Street, which he recommended should be lighted by electricity; but, on the ground of economy, the Committee had decided in favour of incandescent gas-light. Mr. Ellis moved, and Mr. Muirhead seconded, an amendment instructing the Committee to light the street by electricity. It was pointed out that the thoroughfare was one of the main approaches to the centre of the city. Alderman F. Smith said it was purely a question of cost. If the street was to be lighted by electricity, they would have to deal with a number of claims from all parts. The question was: What was the best light obtainable at a reasonable cost? The best light, from the point of view of economy, was incandescent gas; and it was suitable for all purposes. Universal lighting by electricity would involve more for the instalment and fittings than the whole cost of gas. Mr. Austin Taylor pointed out that incandescent gas came to only one-third the cost of the electric light. It was a fine light, and they might double it without spending as much as they would have to spend on electric lighting. Mr. Dart remarked that there would be four burners on each tramway pole; so that the street would be beautifully lighted. Mr. Cohen considered that Renshaw Street, as a business thoroughfare, ought to be as well lighted as possible; and that effect ought to be regarded before cost. It was the public interest to assist in completing the improvement of this thoroughfare. Mr. Jude understood that the saving as between electricity and incandescent gas was in this case £100 a year. For the sake of saving this amount, they were, he said, going to light the street in a second-class manner, and discourage people from coming forward to purchase vacant plots and put up suitable buildings. Mr. Higginbottom said that, personally, he would like to see the whole city lighted by electricity; but the Committee had to look to expense. The extra cost of electricity would be £430 for the initial outlay, and £120 a year afterwards. The amendment was lost by 36 votes to 17.

BURY COUNCILLORS AND THEIR GAS-WORKS.

It is a good thing where gas-works are owned by local authorities to take every opportunity of making the town or district councillors acquainted with the operations of their property. The more they know, the better are they able to appreciate the difficulties which the management has to encounter and the needs of the undertaking. The annual visit to the gas-works of the Town Council of Bury took place a few days ago; and the Chairman of the Gas Committtee (Mr. James Byrom) and the Manager (Mr. H. Simmonds) took advantage of the occasion to increase their visitors' knowledge on many points. To the mechanical stokers which have been recently put in, their attention was specially directed; and they were shown that, by the introduction of machinery, the coal from the time it is delivered on to the railway siding until it is taken away in the form of coke, is not dealt with by manual labour. At a short meeting held in the Committee room on the works, Mr. Byrom argued that gas, properly used, was equal to the electric light, and that as a result of experiments, it was rapidly regaining its reputation as a lighting agent. In regard to the Bury Gas-Works, he said that the capital expenditure had been £180,000; and £103,000 had been paid in interest and sinking fund. He was convinced that at present they were receiving, in return, more per cent. for their money than, and their gas was the cheapest but one of, any other town in Lancashire. Mr. Byrom also referred to his impending retirement from the Council, and wished the members and the town every success in the future. Mr. Simmonds afterwards gave some interesting information as to the use of Mond gas. He also stated that in 1857, the illuminating quality of the gas in Bury was fixed at 12-candle power, and the maximum price at 5s. per 1000 cubic feet. To-day the illuminating power was 18 candles, and the price 2s. 2d. per 1000 feet. Mr. Simmonds then demonstrated to the councillors the effect of using different gas-burners.

MUNICIPAL ADMINISTRATION AT HUDDERSFIELD.

The Alleged Irregularities in the Gas Department.

The Special Committee appointed for the purpose of investigating the charges made against officials, of unfair dealings and actions, and generally into the conduct of members of the Huddersfield Corporation (*ante*, p. 1043), have presented a second report, which was adopted by the General Purposes Committee of the Town Council on Thursday

With reference to the first complaint—that Mr. J. A. Stocks, a brother of Alderman B. Stocks, has been employed by the Gas and Electric Lighting Committees of the Huddersfield Corporation to get out quantities for work in connection with the construction of the electric light works and the reconstruction of the gas-works, and that either Alderman Stocks or his brother, or both, received commission upon a sum of about £100,000 in connection with this work—the Sub-Committee find as follows:—

We find that on March 2, 1892, a meeitng of the Electric Lighting Sub-Committee of the Gas Committee was held, at which a resolution was passed approving the plans prepared by the Electrical Engineer for the erection of the electric light station, and authorizing him to have the quantities taken out. At this meeting, the question of who should be appointed Surveyor was fully discussed; and instructions were given to the Electrical Engineer that Mr. J. A. Stocks should be engaged. Mr. J. A. Stocks was appointed; and his appointment was subsequently ratified by the full Gas Committee, and later by the whole Council.

That at a meeting of the Gas Committee (of which Alderman Stocks was the Chairman), held on Dec. 16, 1893, it was resolved that the work in connection with the reconstruction of the gas-works should be carried out by the

same Contractors as had erected the electric light station, and at the same schedule of prices. Mr. J. A. Stocks was again appointed Quantity Surveyor.

That Mr. J. A. Stocks had been previously—viz., in the year 1889—appointed by the Gas Committee Quantity Surveyor for the erection of a sulphate of ammonia plant.

We find that there was no secrecy or concealment in any way in the appointment of Mr. J. A. Stocks on any of these occasions, and that his appointment had the entire approval of the respective Committees and of the Council.

We further find that the total value of the work certified by Mr. J. A. Stocks was £27,926 4s. 2d., and that the total amount of remuneration paid to him as commission or otherwise in respect of this sum was £523 12s. 6d., which is at the rate of not quite 2 per cent., these totals being made up as follows: Amount certified for the electric light station, £8413 16s. 1d.; commission paid, £167 13s. 6d. Amount certified for the gas-works reconstruction, £17,912 8s. 1d.; commission paid, £323 15s. 6d. Amount certified for the sulphate of ammonia plant, £1600; commission paid, £32 3s. 6d. Only a small proportion of this commission, amounting to £44 8s., was paid directly by the Corporation; the remainder being paid by the Contractors, although the latter were ultimately reimbursed by the Corporation.

The contracts for ironwork and retorts, amounting in value to over £60,000, did not require quantities getting out; and Mr. J. A. Stocks had nothing to do with these, and received no commission in respect of them. In addition to these, about £2000 was expended on job or day work, upon which no commission was paid. The work was done, and the commission paid, during a period of six years; the greater part being between the years 1892 and 1895, inclusive.

We further find that Mr. J. A. Stocks was, during the whole of the period between 1889 and 1895, when the work complained of was done, employed in the office of Alderman Stocks as an architect and surveyor; but on the evidence of Mr. J. A. Stocks, we are satisfied that most of the work was done by him out of business hours, either early in the morning or late at night, and that what was done in business hours was so done with the consent of Alderman Stocks.

We find that Aldermaa Stocks did not receive any portion of the moneys paid to Mr. J. A. Stocks, either by the Corporation or the Contractors, and either as commission or otherwise; but that it was all used by Mr. J. A. Stocks solely for his own purposes.

The second complaint was that Mr. Harman, the Gas Engineer, had a secretaire made out of material belonging to the Corporation, by workmen in the employment of the Corporation, for his own use at his private residence, without paying for such material or labour; and, further, that Mr. Harman had an asphalt walk made at his residence, on the same terms and in a similar manner as the secretaire. Regarding this, the Committee say—

We find that there is absolutely no justification for the charges. The secretaire in question is the property of the Corporation, and not of Mr. Harman, and was made by the instructions of the Gas Committee for official use. The asphalt complained of was purchased by Mr. Harman at its full value in the ordinary course of business, and all work done in connection with the laying of this asphalt was duly paid for. We desire to enter a strong protest against such serious charges as these being made against Corporation officials without sufficient evidence being adduced to support them.

With reference to the last charge investigated—that coals have at various times been supplied to Alderman Stocks and other members of the Corporation from the gas-works at a less price than they could have been obtained from private coal merchants in the town—the Committee report to the following effect:—

We find that coals have from time to time been supplied to the house of Alderman Stocks from the gas-works. The Committee find that the Gas Committee are in the habit of purchasing house coal, not for the purpose of gas making, but to supply other departments of the Corporation which use house coal; and that they have from time to time supplied house coal of a similar nature to the Chairman, and also to Messrs. Thomas Longbottom and Sons, Fred Crosland, Ben Hanson, George Hesketh, James Crosland and Sons, Alderman Haigh, and the Borough Surveyor; but in every single case the coal has been paid for, and the Corporation have made a substantial profit on it. At the same time, the Committee are of opinion that it is undesirable for the Gas Committee to trade in house coal, except merely for the purpose of supplying other departments of the Corporation, and recommend that the practice should be discontinued.

MOND GAS FOR IRON-WORKS.

The Farnley Iron Company are putting down a Mond gas plant at their works; and Mond gas is getting a pretty good advertisment out of it. Among the papers which have noticed the event is the "Yorkshire Post;" and the Editor has given it the advantage of a double innings in his columns. From the last reference to the matter, we make the following extract: The announcement that the Farnley Iron Company are laying down a Mond gas plant at their works is perhaps not one to which "the man in the street" will be inclined at first blush to attach any particular significance. And yet, if all come true that is claimed for this system of power and heating, the time cannot be far distant when factories will discard boilers and furnaces and chimney shafts, and the atmosphere of Leeds and other big industrial centres will no longer be polluted by smoke, nor the walls of their houses and public buildings become blackened by sooty particles. The application of the new system at the Farnley Iron-Works will be chiefly for power as obtained through gas-engines, of which two of 150-horse power are already in working order; space being left for a third of still larger power. Pending completion of the very extensive Mond plant which the Company are erecting, the engines are being run by ordinary gas, generating electricity, which is distributed about the works to various machines and processes which hitherto have required numerous separate steam-engines, with their consequent smoke, dirt, and inconvenience. Besides transmitting power by electricity, the Mond gas is to be conveyed in pipes to smaller engines in different parts of the works, as required. The Company also regard the gas as admirably adapted for certain re-heating purposes in the forge, but they do not consider it suitable for the smelting, refining, or puddling of iron. The re-heating operations for which the new gas is held to be suitable are those which have hitherto been performed by Siemens or other "producer" gas; and the secondary advantages anticipated are less handling of coal and less carrying away of cinders—in fact, a general cleanliness.

ANOTHER ELECTRIC POWER SCHEME.

We learn from the "Newcastle Daily Chronicle" that a Syndicate is being formed for the purpose of erecting a power station in the heart of the Northumberland coalfield, with the object of supplying the collieries with light and current for motive power. The Company will include representatives of the Northern Counties Electricity Supply Company, who are willing to come to an arrangement to take all the current they want for light in the sub-stations. The Northumberland coalfield employs no less than 40,000 miners, giving an annual output of 10,000,000 tons, the bulk of which is produced in the area managed by the Company, the title of which will be the Northumberland Electric Power Company, and they will apply to Parliament during the coming session for an Act empowering them to go on with their scheme. Besides supplying the bulk of the current to the Northern Counties Electrical Supply Company, the new concern will be free to supply current to any others. The scheme has been carefully thought out with regard to economy of production of current, and the stations will be placed in as close proximity to one of the mines as possible, with a view to cheap fuel; and also as near to a spot where water for condensing purposes will be easily obtained. With the latter object in view, a site on the River Blyth or Wansbeck will probably be selected. Our contemporary understands that the scheme has been undertaken simply to meet the long-felt need in Northumberland of cheap locomotion and power development.

ELECTRIC LIGHTING NOTES.

The Nernst electric lamp is being experimented with in Canterbury. A local paper, referring to the fact, says: "Experience of incandescent electric lighting in public thoroughfares has certainly been somewhat of a disappointment to most people, and the prospect of an improvement is therefore all the more gratifying."

Permission has been given by the Local Government Board to the Barnstaple Corporation to borrow £21,600 for electric lighting purposes. This is the estimated cost of providing for the supply of the light within the compulsory area, which is, of course, the centre of the town. The Corporation asked for a loan of £27,000, with a view to extending the electric light to the suburbs; but the Board have not approved of this part of the scheme.

The disposal of the electric lighting profits was the subject of a little conversation at the last meeting of the Eastbourne Town Council. There was a balance of about £1200 last March; and Mr. Climpson expressed the opinion that it should be employed in the reduction of the rates. Mr. Maude explained that the profits were made in the winter, when the hours of burning were long; but he added that the level had now been pretty well reached, and he did not think there was any balance which could be given to the ratepayers. Even if there were, he hoped the Council would bear in mind that the long-suffering consumers, who had supported the undertaking for many years, had a prior claim; for a reduction in price would be far the best procedure, and would lead, no doubt, to a much increased consumption. It is quite refreshing to hear so frank an acknowledgment as this of the rights of the consumers.

Torquay experienced one of the vagaries of the electric light on Wednesday evening, when the current suddenly failed, and the main streets and the buildings depending upon that illuminant were plunged in darkness. Considerable inconvenience was naturally caused. At the Baths Saloon, which adjoins the electricity station, a flower show and concert were being held; but these came to an abrupt conclusion when the light failed. In the smaller hall, which was filled by an audience who were enjoying the musical programme, some candles were obtained, and the lamps were taken from the carriages and cabs outside. These, however, only served to "make darkness visible;" and when, after a weary wait, it became evident that the light might not reappear, the managers of the exhibition advised the audience to disperse. The lamps and candles were used to light the exits, and the people groped their way out and went home. Half-an-hour afterwards, the current was again turned on. In the meantime, the people who were present at the show had, of course, lost their entertainment; and the Gardeners' Association, who promoted the exhibition and concert, were also out of pocket, for the light was extinguished at a time when a considerable increase in the attendance was expected. A claim will, it is said, be made against the Corporation for the loss sustained.

Last Thursday, the Mayor of Hackney (Mr. W. R. Horncastle) formally opened the electricity and refuse destructor works which have been practically completed by the Hackney Borough Council at a total cost of £285,000. The system is the low-pressure continuous-current direct supply at constant pressure on the three-wire plan. The standard pressure is 240 volts at the consumers' terminals, and 480 volts for motive power. The present buildings, which are situated on the banks of the River Lea Navigation Cut, Lower Clapton, afford accommodation for 6000-horse power in boilers, engines, dynamos, and switch gear. Sufficient land has, however, been acquired to permit of a further 6000-horse power being added if necessary. The destructor portion of the plant is not yet complete; but it will consist of twelve furnace cells, capable of burning 160 tons of refuse in 24 hours. A battery of Tudor accumulators, having a capacity of 2800 ampere-hours, will store the energy developed in the destructor at times when it would be otherwise wasted. The generating plant has a total capacity of 3000-horse power, and with the accumulators will be sufficient to supply electric current for some 75,000 lamps of 8-candle power connected to the mains. Some 25 miles of streets have been laid with mains; the total length of cable measuring about 118 miles. For public street lighting, 293 arc lamps, each reckoned to be of about 2000-candle power, have been erected, and these light upwards of nine miles of streets. In order to place electricity at the disposal of every class of consumer, the Council have decided to charge 4d. per unit for private lighting, and 2d. per unit for motive power. The free-wiring system has also been adopted; the necessary wires and fittings being provided and fixed on premises, free of charge, by the National Electric "Free" Wiring Company, on

behalf of the Council. For the use of these wires and fittings, the consumer will be required to pay to the Council a rental of 5¼d. per quarter for each lamp of any standard up to 50-candle power. Mr. R. Hammond is the Consulting Engineer for the scheme.

At the meeting of the Coventry City Council last Tuesday, the Electric Light Committee presented a report on the subject of the charge for electricity, and recommended as follows: (1) That, as from the 1st of January, 1902, the charge for current for lighting be 6d. per unit for the first hour, and 3d. per unit for the third and all subsequent hours, calculated on the maximum demand for the quarter; (2) that, as from the 1st of January, 1902, the charge for current for purposes other than lighting be 1¾d. per unit. Alderman Hill, in moving the adoption of the report, explained the reasons of the Committee for suggesting the proposed changes in the tariff. Mr. West seconded the motion. Alderman Andrews said the policy enunciated in the report seemed to him to be the same disastrous one that had been carried on in the electric light undertaking ever since they had had it—that was to say, selling the article produced at considerably below cost price, and charging the difference upon the rates. He ventured to say that, had the concern been in the hands of a joint-stock company, it would have been in the Bankruptcy Court years ago. The undertaking was only saved from that by fixing an annual charge upon the rates. He saw no sign of any probability of improvement if the policy laid down in the report was carried out. According to the statement contained therein, the actual cost of the electric current per unit appeared to be somewhere about 5¾d., all charges included; and the proposition was to sell a considerable quantity at 1¾d., and a further portion at 1d. In the meantime, the undertaking was going to spend £18,000 more capital. What with additional capital charges and selling the current very much below cost, he foresaw nothing but disaster. Alderman Hill said the experience of other towns was dead against Alderman Andrews's opinion, and in favour of the report. He gave as an instance Brighton, where the Committee did badly for some time till they reduced their prices, and now, he said, it was one of the most flourishing towns in the electric light world. The report was agreed to.

The subject of introducing the electric light into Tipperary was discussed by the Urban District Council at an adjourned meeting last Tuesday night. It came forward on a proposed agreement between the Council and a gentleman representing an intended Tipperary Electric Company, binding the Council to do all that might be necessary to enable the Company, when incorporated, to carry out their objects within the urban district, in consideration of his agreeing to grant the Council the option of purchasing the undertaking, or so much of it as lay within the district. Mr. L. J. Dalton said he thought there were a great many points about the agreement that a business man would not agree to if he were dealing with a lease of his own. He considered the Company should define things more clearly before they asked the Council to agree to them. For instance, the area of lighting should be set down, also the number of lamps they would light, as well as the maximum price per unit they would charge. He believed there were very few who would not like to see the electric light in Tipperary; but they should not do away with one monopoly to create another. The Chairman (Mr. Dalton) said Mr. L. J. Dalton had introduced the word "monopoly." It was to do away with a monopoly that they wished to have the electric light. When it was introduced, unless there was collusion between the Gas Company and the Electric Company, which did not seem likely, the people would get their light at a reasonable figure. He thought the public wanted the electric light. He proposed that the agreement should be adopted, and the seal of the Council affixed thereto. Mr. English seconded the proposition. Mr. L. J. Dalton proposed, as an amendment, that the seal be not affixed to the document until more definite particulars were before the Council. Mr. Lyons seconded the amendment. The Solicitor (Mr. Frewen) explained that the agreement did not bind the Council to anything beyond giving the Company facilities for carrying on their work. They could attach any conditions they wished. After some discussion, the agreement was signed and sealed.

At the meeting of the Court of Common Council last Thursday, the Streets Committee brought up a report on the reference of the 29th of September relative to a letter from the City of London Electric Lighting Company, offering to continue the public lighting in the western and central districts (in regard to which the contracts with the late Commissioners of Sewers had been declared invalid) at the same price, and subject to the same conditions, as heretofore, provided the arrangements as to the public lighting in all three districts—western, central, and eastern—be fixed until 1914, when the Corporation's power of purchase first arises. They stated that, in view of the circumstances surrounding the question, the Committee had deemed it expedient to adjourn the consideration of the letter until February. Mr. Clough said he wished to move the following amendment: "That, having regard to the anomalous position of the Corporation in regard to the electric lighting of the City by reason of the fact that two out of the three electric lighting contracts have been declared null and void, while that relating to the eastern district, which comprises 45 per cent. of the present lighting, remains valid and existing, this Court is of opinion that negotiations should be entered into with the City of London Electric Lighting Company, with a view to arrive at an equitable arrangement in regard to the City generally, which shall be satisfactory and acceptable to both parties; and that it be referred to the Streets Committee forthwith to open up negotiations with the Company accordingly, and to report." He said if this amendment were adopted, he should further move: "That it be an instruction to the Streets Committee that, in the opinion of the Court, although the present situation is an opportune one for the readjustment of the conditions of public lighting so as to secure to the Corporation the full advantage of modern scientific advance, it should not be used to prejudice the position which the City of London Electric Lighting Company would have held had not two of the three agreements been declared invalid." Before moving either of the amendments, Mr. Clough proposed that strangers should withdraw, as the whole question was *sub judice*. Mr. Brooke Hitching seconded the proposition. Mr. A. C. Morton opposed it, and protested against the ratepayers being plundered of millions of money by means of company-promoting schemes. He said that it would be cowardly to discuss the question with closed doors. Mr. Judd declared that the present *impasse* was due solely to Mr. Morton, to whom they owed the existing chaotic state of the streets. Several members spoke in favour of the debate taking place with closed doors, and deprecated the attack made upon Mr. Morton. Mr. Clough, in reply, said he had nothing to do with the Electric Lighting Company; his sole interest was the welfare of the Corporation. The proposition was carried by a majority of 34. After a private deliberation, the Court appointed a Special Committee of 15 members to consider the whole matter, and to report forthwith.

The discussion of the Tiverton electric lighting scheme has advanced considerably within the last week or so. A public meeting, convened by the Mayor, at the instance of a number of ratepayers opposed to the scheme, was the means of eliciting a good deal of information both as to the proposals which the Corporation are considering and the expectations which are entertained as to the financial result. It is proposed to purchase Washfield Mills, and to utilize water power for the generation of electricity. The price to be paid for the mills could not be ascertained at the meeting, but the estimated cost of the whole scheme is £11,200; and provision is to be made for a supply equal to 2500 lamps of 8-candle power. Mr. Adams, the Engineer of the scheme, expressed himself confident that the water power would be sufficient, even in the driest season, to supply three times the quantity of electricity which would be needed at the outset. Mr. J. Salter asked if there was an instance in which a town of the size of Tiverton had made an electric lighting scheme pay from the first. Mr. Adams answered the question in an indirect manner by saying that he knew no town which had such unique advantages as Tiverton in the matter of water supply. The question of the competition of the electric light with the municipal gas undertaking was mentioned by Mr. J. Carpenter, who pointed out that, although the Corporation had had their electric lighting powers since 1888, they had purchased the gas-works since then for £22,000, and now proposed to set up electric lighting works in opposition. In answer to a question, Alderman Thorne, Chairman of the Lighting Committee, stated that the gas-works produced a profit of £900 a year. Mr. Salter moved a resolution calling upon the Town Council to abandon the Washfield Mills scheme. He expressed the opinion that it would not be profitable, and that, even if it were, it would be only at the expense of the gas undertaking. Mr. Carpenter moved an amendment to the effect that no electric lighting scheme was desirable. The amendment was lost on being put to the vote; but the resolution was carried, though opinion at the meeting seems to have been pretty evenly divided, for it was only on a second show of hands being taken that the Mayor could come to a decision as to which way the voting had gone. The subject was again considered by the Town Council yesterday week. Alderman Amory, who then spoke in opposition to the project, instanced the case of Worcester as one in which a water power undertaking had failed. He submitted an estimate according to which the scheme proposed would cost £18,650, instead of the £11,000 estimated by Mr. Adams; and he reminded the Council that experts were not infallible. A resolution in favour of abandoning the Washfield Mills scheme was defeated, as was also a proposition to obtain further expert advice. It was, however, unanimously agreed that Alderman Amory's figures should be submitted to Mr. Adams and the Borough Surveyor, and that another meeting should be held to consider their report.

RATING OF THE EAST LONDON WATER COMPANY.

Valuation Appeal.

At the Westminster Palace Hotel, on the 24th, 25th, and 26th ult., Mr. HORACE AVORY, K.C., held an inquiry into the rateable value of the hereditament of the East London Water Company. The inquiry arose out of an appeal by the Company to the County of London Sessions against the rating by the Assessment Committees of several East London parishes, when the Court remitted the case to Mr. Avory to ascertain the rateable value and report.

The parishes concerned, and the Counsel appearing, were: Hackney, Mr. MARSHALL, K.C., Mr. E. HARRISON, K.C., and Mr. W. RYDE; St. George's, Mr. MARSHALL, Mr. HARRISON, and Mr. STONE; All Saints', Poplar, Bromley, St. Leonard, and Stratford-le-Bow, Mr. MARSHALL, Mr. HARRISON, and Mr. R. C. GLENN; St. Anne's, Limehouse, and the Hamlet of Ratcliff, Mr. MARSHALL, Mr. HARRISON, and Mr. B. HOUGHTON; Bethnal Green, Mr. MARSHALL, Mr. HARRISON, and Mr. JENKINS; St. Leonard's, Shoreditch, Mr. MARSHALL, Mr. HARRISON, and Mr. RYDE; and Woolwich, Mr. E. S. SINCLAIR COX. The Company were represented by Mr. BALFOUR BROWNE, K.C., Mr. C. A. CRIPPS, K.C., and Mr. DOUGLAS BARTLEY.

Mr. BALFOUR BROWNE, in opening, said, barring the largeness of the figures, the problem before the Arbitrator was very simple. He had first to arrive at the rateable value of the whole of the water undertaking, and then, from that figure, to arrive at the rateable value of the parochial parts. There would, of course, be large differences of opinion between the two sides as to the figures; but there would be no dispute as to the method. In this particular case, the first thing was to find out the rateable value of the hereditament as a whole; and they started with the sum of £364,420, the gross receipts of the account year ending June 24, 1900. This was arrived at by taking from the half-yearly accounts the water-rate for the last half of 1899 and the first half of 1900, which provided a figure of £371,359, from which had to be deducted certain sums representing losses—empty houses, houses pulled down, rates reduced, rates charged in error, rates allowed, and bad debts—amounting in the two half years to £6957, leaving £364,402. Then to this had to be added £18 received from the Southwark and Vauxhall Water Company, giving the figure started with. From the gross receipts had to be deducted the expenditure—amounting in all to £133,154. The method by which this figure was arrived at was by taking from the accounts the cost of maintenance and repair of service reservoirs, pipes, &c., and maintenance and repair of pumps and pumping-engines. In this connection, Counsel remarked that, in consequence of the Company's supply having been drawn upon, they had had to sink their wells

deeper, and they had been at greater cost in raising the water to the surface—a very large quantity of the water that was formerly only once pumped having now to be pumped twice. Expenses had also been increased in the particular year by the rise in the price of coal; but Counsel hoped the latter would not be a permanent charge. There was an item of £6357 for abstraction of water from the Thames and Lea. Especially during the last half of 1899, the Company were not, without the assistance of other Companies, in a position to supply their customers; and they had to borrow or buy water from elsewhere. This was a serious matter, representing a sum of £30,829. The amount stated as the total expenditure was £165,057; but to this had to be added certain other expenses, such as management, &c., which gave £197,688. Deductions amounted to £78,331, leaving £119,357. But there still had to be added one-fifth (the year's proportion) of the cost of water paid to other Companies—£11,730—and a payment of £2067 to the Lea Conservancy, making together £133,154 as the total working expenses. Subtracting this from the gross receipts gave £231,266 as the net receipts, which were divisible between landlord and tenant. The first person to be considered in these matters was the tenant; and he would first require a certain amount of cash to meet outgoings. The question was, however, how much. It was first of all necessary to deduct landlord's statutables, £21,153; leaving the tenant £112,001 as working expenses. Five-eighths of this sum—that was, 7½ months—£70,000, would be required as capital. Then there were two-quarters' rates paid in advance, £22,337. So that the tenant required to meet outgoings to the amount of £93,338. Included in the tenants' requirements would be: Value of meters, £62,850; value of office furniture and loose plant, £27,338; tenant's stores, £3726; and a balance at bankers for contingencies, £12,000—a total of £198,252. On this was claimed 17½ per cent.; and therefore, if the amount of capital was right, that would make £34,650 as the tenant's share, which, deducted from the £231,266, left £196,616. Then from this had to be subtracted the necessary sinking fund to maintain the hereditament in a condition to command the rental. The present structural value of the works was calculated at £1,575,556; of pumping, carrying, and service mains, £975,587; and the estimated cost of renewing the paving over mains, £230,920—a total of £2,782,063. From this was deducted the value of the Walthamstow open reservoir (£480,000), which was taken out because it did not require renewal at the present time, and £9850, the value of an open river, for the same reason. The remainder, £2,292,213, was, in the opinion of the Company's advisers, the structural value of the perishable portion of the undertaking. One per cent. had been allowed for the sinking fund—£22,922; but in this was included a sum of £5000 which had been expended and placed under repairs, but really was devoted to improving the hereditament, and therefore ought to come out, leaving £17,922 as the sinking fund. Subtracting this from £196,616, left £178,694—the rateable value of the entire undertaking, *plus* rates. Proceeding, Counsel pointed out that the directly contributing and the indirectly productive portions should be separate, and said the Company's witnesses had valued the land and works, with an average rate of 6s. 1d., at £109,747; pumping and carrying mains, £44,065; rateable value of Company's offices in St. Helen's Place, £750; and the rates upon it, £213. Therefore the total rateable value of the indirectly productive portion, *plus* rates, amounted to the sum of £23,919. Then as £23,919 was to £364,420, so was the percentage for each parish. This gave 6·56 per cent. of the total gross receipts; and it was applied in this way: Take the case of North Woolwich. The water-rental there was £3146. The rateable value of service-mains, *plus* rates, calculated at 6½ per cent., gave £205 as representing the directly contributing part in the parish. Take from that the rates at 7s. in the pound, which Counsel believed was the amount, and there was left the rateable value of £152. Adding the carrying mains—5 per cent. on £666—the value of the indirectly contributing plant in the parish gave £33, which, in its turn added to the £152, gave the rateable value for the water-mains in the parish as £185. Mr. Sinclair Cox had remarked that Woolwich was a small matter; but the figure appealed against was £420 gross and £350 rateable, while the Company made it only £206 gross and £185 rateable. That was a small parish; but, in the case of St. George's, for example, the total rateable value of the mains was £785, and of the service-mains £416; and the gross value on this was taken by the Company at £1000. One of the largest, however, because of the gross receipts in it, was Mile End old town. There were gross receipts of £22,487; and 6½ per cent. on that gave a rateable value of service-mains, *plus* rates, of £1462. It would, of course, have to be proved that the receipts were a certain amount; but once the amount had been ascertained at a percentage, it was an easy matter to apply the rateable value to the whole.

The ARBITRATOR: Is there any dispute between the parishes in this case about the proportion?

Mr. MARSHALL: The method of doing it is the same. We determine what the percentage will be; and that will be applicable to all the parishes. There will not be different percentages for each parish.

Mr. *William Marshall*, examined by Mr. CRIPPS, went through the figures he had prepared, substantiating Counsel's remarks.

Friday, Oct. 25.

Mr. *Marshall*, in further examination by Mr. BALFOUR BROWNE, said he had gone closely into the matter of the sinking fund. The 1 per cent. was an old figure—a principle adopted thirty years ago. At present, when the Company had all modern machinery—high pressure, and so on—he thought the sinking fund ought to be higher. Originally they had the old Cornish pumping-engines; but now they had Worthington and various other modern engines, which lasted about half the time, and required a very much larger amount expended upon them in maintenance. One per cent. represented roundly a life of about fifty years. There were 998 miles of pumping and carrying mains, varying in size from 6 inches upwards.

In cross-examination by Mr. F. MARSHALL, witness stated that he had deducted a sum of £90 received from the Southwark and Vauxhall Water Company, in order to spread the receipts over five years—£18 a year. Nothing was received previous to the year 1899-1900.

Mr. MARSHALL: Why average the receipts over the previous four years, if nothing was received?

Witness: I thought that, in order to be consistent, we had better average it over five years, the same as we have done in the case of the other amount paid for water—£30,000 odd.

Were the East London Company in a position to offer a supply in any year prior to the account year? This is the Company, as I understand, supplying the Southwark and Vauxhall Company, for which they received the £90?—I do not know when this supply took place. It is a small matter. It is sums received from the Southwark and Vauxhall Water Company for a temporary supply through the Tower Subway. I do not think the Company had the Tower Subway five years ago.

The ARBITRATOR: It is only a sum of £18.

Mr. MARSHALL: It is the difference between £18 and £90—£72. Our surveyors have included the whole of it.

In reply to further questions, witness said he thought the Company had taken 300 million gallons of water from the Grand Junction Company this year. He was informed that the East London Company would have to pay very nearly as much this year for water as in the account year they were dealing with.

Mr. BALFOUR BROWNE: It is £25,000 this year.

Questioned as to the structural value of the undertaking, witness said he estimated the land to be worth £134,336. He valued the intake works, storage and impounding reservoirs, culverts, open river, &c., at £531,178; filter-beds and appurtenances at £335,523; pumping-stations, with wells, at £228,413; pumping-stations, without wells, at £384,437; service reservoirs and appurtenances, at £64,589; and wharf, sidings, turbine-houses, plant, offices, &c., at £31,496.

Saturday, Oct. 26.

Mr. *W. Marshall* was further cross-examined at great length by Mr. F. MARSHALL as to the figures for the structural works. He said the Walthamstow reservoirs had a total capacity of 1270 million gallons. From this, he deducted 70 million gallons for bottom water, leaving an available capacity of 1200 million gallons, which he valued at £400 per million, or £480,000. The Company had eight reservoirs in 1886; and at that time he valued them at the rate of £350 per million gallons. But it would cost now quite £50 a million gallons more to make them than in 1886. His figure of £400 was a very moderate one. His valuation in 1886 was made for rating purposes; the Company in that year appealing against the rating of seventeen parishes. The filter-beds, including sand and gravel, he valued at 45s. per square yard, or nearly £11,000 an acre; and they could not be made for less now.

Counsel pointed out that one of the filter-beds, which had been valued in 1886 at £8930, was on the present occasion valued at £10,533, though no new works had been constructed. Witness, in reply, said that sand had very largely increased in value. In 1886, sand was worth 3s. per cubic yard; while at the present time they could not get it for less than 7s. 6d., and might have to pay more. Witness was then questioned in detail as to the figures he had given for the pumping-engines with wells. After some time,

The ARBITRATOR asked if the respondents intended to challenge all the figures of the valuation.

Mr. MARSHALL replied that they had some difficulty in identifying the various items, and were obliged to ask for the details.

Mr. BALFOUR BROWNE said he would suggest that the parishes must have valued all these things for the purpose of making their own valuation. They might state where their valuation seriously differed from that of the witness, and inquire into the details of these items. Some of the values were taken from the Company's books, and some had been arrived at by Mr. Marshall.

Mr. MARSHALL pointed out that there had been in some instances a large increase—in two cases of £7000 and £11,000—between the valuation of 1886 and the present valuation.

In further cross-examination, witness said he had not taken anything off the price of the pumping-engines for depreciation. The Company kept them up well; and they were worth quite as much to them at present as when erected.

Witness was then cross-examined as to the deduction he had made for sinking fund, which was necessary for the renewal of the perishable part of the Company's undertaking. This applied to four classes—land, engines, buildings, and mains. First taking the mains, he stated that, in the case of the Grand Junction Water Company, it was given in evidence that their mains had lasted without renewal from the formation of the Company to the present time. Witness said he knew some of the large mains had lasted for seventy years certainly; and there had been no renewals. Witness said he could not agree that in the case of the Grand Junction Company there had been no renewal of the engines. If the engines had been rebuilt, or the cylinders had been re-bored, he looked upon that as a renewal, and not a repair. As to the mains, there had been no renewal. When these were put in clay or good ground, they would last a long time; but if put down in made-ground, he had known them require renewal in twelve years. He had not taken any figure for the life of a main, but had adopted 1 per cent., which was a well-known recognized allowance.

Mr. MARSHALL: One per cent. would be, on the 3 per cent. table, equal to a life of 47 years. If you take the life of all the undertaking at 60 years, the amount would be 6 per cent,

Witness said he would not think of doing that. He estimated the net rateable value of the undertaking at £84,151, on which the average rates were 6s. 1d. This would make the rates payable £25,596. During the year ending June 30, 1900, the Company had paid rates amounting to £37,694, on a total assessment of £113,590.

Cross-examined by Mr. SINCLAIR COX, witness said the receipts from water rents and rates in Woolwich during the year ending June, 1900, were £3146. The receipts for the year 1899 were £3416; but he did not know the reason for the reduction. The net valuation of the Company had been raised from £145 to £350. According to his figures, the amount should be £185.

After a short re-examination of witness by Mr. BALFOUR BROWNE, the proceedings were adjourned until Friday next (Nov. 8).

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The address which Mr. W. Foulis delivered in Glasgow last week as President of the Institution of Engineers and Shipbuilders in Scotland, given in another column, is a masterful exposition of the elements which govern gas supply in the present day. To members of an Institution, all of whom are busy men, the address would be welcome, as making them familiar with the work which lies to the hand of toilers in another department of the scientific world, which they have not time themselves to investigate, and which some of the more unthinking of them may have begun to imagine was a department so far played out that it was worth little consideration from them. Mr. Foulis's address reaches more people whom it is desirable to educate than would have been the case had he delivered it before a body of gas engineers. It is therefore more valuable, even in the abstract; but its value is vastly enhanced when the quality of the address is taken into account, and the standing of the author, who, in the ken of the members, spoke with a fulness of knowledge which could not be equalled in Scotland. The conviction carried to the listeners must have been that, when Mr. Foulis believes in the future of gas supply, there must be ground for his doing so.

A veritable bomb-shell has fallen among the ranks of gas managers in Scotland, in the proceedings at Arbroath. It has been known for a week or two that a Special Sub-Committee have been considering the subject of the management of the gas-works. About a week ago, this Committee submitted their report; and it was agreed that a copy of it should be sent to the Manager (Mr. R. S. Carlow). The next stage in the proceedings is contained in the following announcement, which is published to-day: "A meeting of the Arbroath Gas Corporation was held last night in the Town Hall—Provost Grant presiding. The meeting was held in private; and after a sederunt of three hours—from 7 to 10 o'clock—the reporters were asked to attend, when the following was read by the Clerk: After the report of the Special Committee had been carefully considered and fully discussed, Bailie Duncan moved—That Mr. Carlow be asked to resign as at Dec. 31 next, and, failing his doing so, that his services be dispensed with at that date. Mr. Napier seconded the motion. Mr. Keith moved, as an amendment, that Mr. Carlow's services be retained for three months at a reduced salary of £200 per annum, and that he repay the gardener's wages by instalments, to be afterwards arranged. Mr. Forbes seconded the amendment; and on a vote being taken, there voted for the motion—Provost Grant, Bailies Alexander, Melvin, and Duncan, Messrs. Robbie, Lorimer, Henderson, Robertson, Napier, and Corsar—11; for the amendment—Messrs. Forbes, Dorward, Thomson, M'Wattie, and Keith—5. Mr. Forbes entered his dissent. Mr. Lorimer moved that Mr. Andrew Taylor, the foreman, be dismissed, which was unanimously agreed to." The reason for this very drastic step is not disclosed; and it would be unfair to make any comment upon it, further than to point out that, so far as can be seen, Mr. Carlow does not appear to have been heard upon whatever may have been alleged against him. Of course, he may have been heard; but if he has not, his reply might be an effective answer to whatever is alleged against him. What that is has not been allowed to transpire, beyond what is contained in the official communication as I have given it; and from this, it would appear to have been a misunderstanding as to the employment of a gardener. If that be all, surely it is a poor matter to bring up against an official who has done so much good work for the Corporation of Arbroath. So far as outsiders can form an opinion, the gas undertaking in Arbroath has been the best managed of all the work of the Corporation. This has been so much the case, that a few years ago the Corporation obtained parliamentary powers to charge the Gas Corporation with a sum of £200 a year with which to subsidize a moribund Harbour Trust; and this amount has since been regularly paid. We know that the water scheme of the town is far from being a success; but that anything was suspected to be wrong at the gas-works, there never has been a whisper of until this sudden development. I think I voice the sentiments of all the gas managers in Scotland when I say that Mr. Carlow has the sympathy of every one of them. If it should be that such an active and cheery gentleman should disappear from their ranks, the loss will be a great one; and, considering the position he has so long and worthily filled, as the Secretary to the North British Association of Gas Managers, the deprivation will be all the more keenly felt.

At the monthly meeting of the Edinburgh and Leith Gas Commissioners on Monday, one of the Commissioners, who I would say has not yet been sufficiently "formed," was brought to task for a rash remark he had made to the electors in Leith, to the effect that the present mode of settling the coal contracts, by the Commissioners, opened the way for questionable practices among the officials. He seemed to think that only half-an-hour was bestowed upon the consideration of the coal tenders, of which there were a great many; whereas the truth is, as was stated by Mr. Purves, that a Sub-Committee spent many hours in considering them. I do not know what put the idea of questionable practices into the gentleman's head; but that is the reason I speak of his want of "form," because, if he had taken thought for a moment of the prices paid, he would have been forced to the conclusion that there was no room for questionable practices. Until a concrete case arises, it is a sign of an unhealthy mind to go about prating for evil. I suppose the system of the Commissioners would make questionable practices possible, as, indeed, would any conceivable system, if there was an inclination that way; but the fact is that the Commissioners trust their officials. Considering the past, they have good reason to do so; and so long as this feeling exists, there can be nothing but condemnation of any endeavour to create another state of matters.

The Commissioners had a talk over the price of cheap coke for the poor, which they fixed at 3d. per bag—a figure that will entail almost no loss. But this was a detail of administration. It was more interesting to learn from Mr. D. Purves, the Convener of the Works Committee, that there was an increase in the output of gas during September of over 5 million cubic feet, and that since May the increase has been more than 10 million cubic feet. Also from September to September there had been an increase of 1064 in the number of gas-cookers let on hire. Further, that the new gasholder at Granton has been filled, and has been found to be very satisfactory.

The Commissioners agreed to inaugurate a new business—that of briquette making. Mr. Purves said that the Works Committee had gone very carefully into the matter. They had the briquettes burning in the fire there that day. After full and careful consideration, the Committee recommended that plant for the manufacture of briquettes be set up, at a cost of £2500. On such an outlay, after allowing for sinking fund and interest and all the charges relative to the machinery, there would be a very fair profit. They asked the Commissioners to approve of their acceptance of the tender they had for the plant; and also of the offer of the same firm—Messrs. Graham, Morton, and Co., of Leeds—for conveyors and other plant, making altogether about £3000. This was agreed to without comment.

The Town Council of Glasgow on Monday considered an important question regarding the lighting of streets, common stairs, and courts, of the latter of which there are a great many in the city. The whole cost of the service falls upon the occupiers of property; the Corporation charging 10s. a year for each burner in a stair, and 15s. for each one in a court. The money is collected by the proprietors along with the rents of their properties; and in respect of the trouble of collection and the risk of bad debts, the proprietors are allowed a rebate of 2s. per burner when accounting to the Corporation. Last year an endeavour was made to alter the system by legislation, so as to throw a portion of the cost of the lighting upon the proprietors; but the attempt failed. At this week's meeting of the Corporation, Mr. Buchanan revived it by moving that, in view of the great injustice done to the occupiers by the imposition on them of the whole cost of the lighting, it be remitted to the Watching and Lighting Committee to reintroduce clauses into the first Bill to be promoted in Parliament for the purpose of imposing a lighting assessment, payable half by the owners and half by the occupiers. He said that last year the proposal was lost because of the opposition of the Landlords' Association. It was a question of considerable importance, because it cost the occupiers £88,000 a year to light the public streets, common stairs, and private courts. The charge of 15s. per burner for lighting the courts did not cover the cost by 50 per cent.; and the whole deficit was made to fall upon the occupiers. The cost of lighting common stairs was about £38,000 a year, and the revenue was short by £21,000. In addition, the rebate to proprietors amounted to £5700; and this had to be made up by the occupiers. Mr. Paton moved that the subject be remitted for consideration and report, because, if carried as it was, the motion would compel the Corporation to introduce into a Bill the most debatable clauses they could conceive. Lord Provost Chisholm suggested that the first part of the motion should be deleted. Mr. Buchanan agreed to this being done, and to the remit being to the Committee to prepare clauses and to report. This simply postponed the struggle, which will be a tough one. I must say that my sympathies are with the owners. It is the occupier who derives nearly the whole of the benefit from lighting. The advantage secured by the owner is infinitesimal—so much so as to make it almost impossible to fix a value upon it.

The elections for the municipal honours in Scotland are all but over. I observe, among many references to gas-works administration, that in Peebles one of the candidates told the electors the other night that at present they have 206 gas-lamps, which cost the town £206 a year; and that it has now been proposed to light the streets with 28 electric arc lamps, at an annual cost of £580. Naturally, the enthusiasm in Peebles for electric lighting is not very strong.

I think about the only other municipal contest I need mention is that at Falkirk, where Provost Weir is opposed by Mr. W. W. Neilson, who was long the Superintendent of the water undertaking of the Corporation. Mr. Neilson, after he was retired by the Water Trust, had a long litigation with them, as to his remuneration. He was only partially successful; and in this contest he is endeavouring to show that he could have secured for the community, for £20,000, a water supply for which they will pay £100,000. The reply of Provost Weir is that Mr. Neilson's scheme was tried; and that, although only about half completed, it cost 50 per cent. more than Mr. Neilson's estimate. If it had been finished, he reckoned that the estimate would have been proportionately exceeded for the second half of the work.

The Oil-Gas Enrichment Company's annual report is issued this week. It is not yet ten years since this Company came into existence. When it did, it was thought that the gas industry had obtained relief from the burden, which was then beginning to be heavily felt, of the high prices charged for cannel. But since then two things have happened—the price of oil has risen so much that it nearly equalizes the cost of cannel, and the oil process has become hardly, if at all, profitable; and there has been a great advance in incandescent gas lighting, which has led to the movement for doing away altogether with high-quality gas. These have to a large extent adversely influenced the fortunes of the Company. There is a third element to be taken into consideration, though now only of second-rate importance, which is that there is still a future for oil gas, under certain conditions. The discovery of Mr. W. Young, of Peebles, that oil could be made into gas by a process of fractional distillation, if it has been superseded commercially at present, is still scientifically a perfect process; and, to my knowledge, there is a field before it still, notwithstanding the adverse position of the markets and the present trend of expert opinion.

The dry weather still continues in the East of Scotland. On Tuesday, there was a copious rainfall; but such is the absorbtive nature of the ground, that it only had the effect of raising the reservoirs about 3 inches. Since then there has been no rain. The weather, in fact, though the season is now into November, is of a most pronounced Indian Summer nature. The strange thing is that rain is abundant in other districts; and, indeed, there are sad accounts of flooding in some places.

Colonel A. G. Durnford, Local Government Board Inspector, held an inquiry at Atherton last Thursday, concerning an application by the District Council for sanction to borrow £3000 for gas-works extensions. There was no opposition.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 2.

Sulphate of Ammonia.—Throughout the week there has been a firm market. Values have improved slightly, and the closing quotations are £10 13s. 9d. per ton f.o.b. Hull, £10 17s. 6d. per ton f.o.b. Leith, and £11 per ton f.o.b. Liverpool. Although production is increasing as the days shorten, supplies have been readily absorbed, and November opens with only working stocks. Shipments to France and Belgium, which for six months had shown a large decrease as compared with the same period in 1900, have in October improved distinctly; and the cheapness of sulphate of ammonia compared with nitrate of soda, should encourage still further in this direction. So far, home manure manufacturers are only buying to cover their immediate requirements. Interest in the forward position is sustained; and after acceptance of £10 16s. 3d. per ton London, Beckton terms, for November-December delivery, £10 17s. 6d. per ton is now required. For January-March £11 2s. 6d. per ton is quoted, London, Beckton terms, and £11 5s. per ton, ordinary terms, for January-June, f.o.b. Leith.

Nitrate of Soda.—Owing to arrivals, 9s. 1½d. per cwt. has been accepted for ordinary nitrate of soda *ex* quay; but at the close the quotations are again 9s. 3d. and 9s. 4½d. per cwt. for ordinary and refined qualities respectively.

LONDON, *Nov.* 2.

Tar Products.—The market for pitch continues very firm; and it is extremely difficult to obtain supplies, especially in London. The demand for South Wales is also very good; and patent fuel makers are now beginning to consider business for next year. In benzol, small quantities of 90 per cent. have been placed at 9¾d.; but, as a rule, makers ask 10d. for December delivery. 50-90 per cent. is rather dull of sale; and consumers will not pay more than 9d. for delivery this year. Carbolic is very firm for prompt delivery, 1s. 11d. having been paid on more than one occasion for November shipment. A large business is, however, reported at 1s. 10½d. for November-June. Crystals are still quiet; the demand does not appear to be very strong at present. The German makers are evidently monopolizing the business. Creosote is decidedly better in the North, the demand having improved. Makers have accordingly advanced their quotations, and it is more than probable the same will be well maintained, some of the largest Yorkshire makers being very firm in their ideas. There is nothing fresh to advise in tar, and prices remain stationary.

The average values obtaining during the week are: Tar, 14s. 6d. to 17s. 6d. Pitch, east coast, 33s. 6d. to 34s.; London, 35s.; west coast, 31s. 6d. to 32s. Benzol, 90's, 9¾d.; 50's, 9d. to 9¼d. Toluol, 10d. Crude naphtha, 4¼d.; solvent naphtha, 11d. to 11½d.; heavy naphtha, 10d. to 11d. Creosote, North, ⅞d. to 1d.; London, 1⅛d. Heavy oils, 2d. to 2¼d. Carbolic acid, 60's, 1s. 10½d. Naphthalene, 60s. to 80s.; salts, 35s. to 45s. Anthracene, "A," 2¼d. to 2½d.; "B," unsaleable.

Sulphate of Ammonia.—The market is quiet. There appears to be a fair business doing for January-March. The situation remains the same as regards Beckton, who ask £10 16s. 3d. November-December, but do not appear anxious to sell for this period, preferring business for January-March at £11 to £11 2s. 6d. In Hull, further business has been done at £10 15s. for November; but for December makers ask £10 16s. 3d., and in some instances £10 17s. 6d. Business is reported from Leith at £10 15s. early shipment; while an offer of the same price was declined for November-December by one of the largest makers. As regards Liverpool, the demand is very good indeed for early shipment; and high prices are reported to have been paid.

COAL TRADE REPORTS.

Lancashire Coal Trade.—Not more than a steady tone continues to be maintained in the round coal trade of this district, with no quoted change from the rates ruling last month. For house-fire consumption, the demand is still below the average for the time of the year; and the output of the collieries fully keeps up with orders—stocks remaining practically untouched. In the Lancashire district, list rates remain firm at about 15s. per ton at the pit for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four-feet and seconds Arley, and 11s. to 11s. 6d. for common house coal. But at some of the Yorkshire and Derbyshire collieries, full current rates are only with difficulty being maintained. The lower qualities of round coal move off moderately, for iron-making, steam, and general manufacturing purposes; but supplies are ample, and 9s. to 9s. 6d. per ton represent the full average figures for good qualities of steam and forge coal. The larger quantities of common coal now going away for gas making, of course, help the collieries; but the position, taking it all through, is not a strong one. The shipping demand is fairly good, with steam coals quoted at about 10s. 3d. to 10s. 6d. per ton delivered at the ports. Except that some of the best qualities of Lancashire slack meet with a ready sale, and are firm at late rates, the engine fuel trade generally remains very unsatisfactory; and medium and inferior sorts of slack are pushed on the market at extremely low figures—both Derbyshire and Yorkshire competing keenly with local collieries. At the pit, best Lancashire slack is quoted from 7s. to 7s. 6d. per ton, with the lower qualities about 5s. 6d. to 6s.; but slack from Derbyshire can be bought at the pit at from 2s. 6d. to 3s. 6d. per ton, according to quality. The coke trade in this district continues active, with prices well maintained at late rates—averaging 23s. to 25s. per ton for foundry, and 14s. to 15s. for good washed furnace cokes, at the ovens. Yorkshire coke, however, seems rather more plentiful since the increase of production; and prices there are barely being held to full rates.

Northern Coal Trade.—There is a very strong demand for Durham gas coals, but other classes are not quite so brisk. Best Northumbrian steam coals feel the loss of the business from the Baltic, and may be quoted at about 11s. 6d. per ton f.o.b. Second-class sorts are 10s. 6d., and steam smalls from 5s. 10½d. to 6s. In the gas coal trade, there is a steady and even full demand, and prices are relatively very high and firm. Best Durham gas coals are quoted at 12s. 6d. per ton f.o.b. for

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1159.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	12¾—13¼	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb.	100—102	..	4 18 0
200,000	5	May 15	6⅓	Bombay, Ltd.	6⅛—6⅜	..	4 16 4
40,000	5	,,	6⅓	Do. New, £4 paid	4⅛—4⅜	..	5 9 5
380,000	Stk.	Aug. 15	12	Brentford Consolidated	265—270	..	4 8 11
270,000	,,	,,	9	Do. New	192—197	..	4 11 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	130—135	..	3 14 1
206,250	,,	June 14	4	Do. 4 p.c. Deb.	114—117	..	3 8 5
220,000	Stk.	Sept. 12	10	Brighton & Hove Orig.	222—227	..	4 8 1
246,320	,,	,,	7	Do. A. Ord. Stk.	155—160	..	4 7 6
1,047,500	Stk.	Aug. 28	5	Bristol, 5 p.c. max.	118½—119½	..	4 3 8
420,000	20	Sept. 27	10	British	41—42	..	4 15 3
50,000	10	Aug. 15	12	Bromley, Ord. 10 p.c.	24—26	..	4 12 4
82,850	10	,,	9	Do. 7 p.c.	19—21	..	4 5 8
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
150,000	20	July 17	8¼	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14⅛—15⅜	..	6 9 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
550,000	Stk.	Oct. 11	12	Commercial Old Stock	270—275	..	4 7 3
236,425	,,	,,	9	Do. New do.	203—208	..	4 6 7
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	165—170	+2	5 5 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	162—167	..	4 3 10
575,000	Stk.	Aug. 29	5	Crystal Palace Ord. 5 p.c.	122—127	..	3 18 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—128	..	3 18 2
486,090	10	July 17	10½	European, Ltd.	19—20	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15	..	5 5 0
15,079,885	Stk.	Aug. 15	4⅛	Gas-light and Coke — 4 p.c. Ord.	97—99	..	4 8 10
2,600,000	,,	,,	3⅜	Gas-light and Coke — 3⅜ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	Gas-light and Coke — 4 p.c. Con. Pref.	112—115	..	3 9 7
4,063,425	,,	June 14	3	Gas-light and Coke — 3 p.c. Con. Deb.	92—94	..	3 3 10
70,000	10	May 31	8	Hongkong & China, Ltd.	13⅜—14½	..	5 10 4
3,800,000	Stk.	May 15	10	Imperial Continental	213—216	..	4 12 7
473,600	Stk.	Aug. 15	3½	Do. 3 ⅜ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Aug. 29	10	Liverpool United A	231—233	+1½	4 5 10
718,100	,,	,,	7	Do. do. B	170—172	..	4 1 5
306,083	,,	June 28	4	Do. do. Deb. Stk.	119—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd.	4⅛—5	..	4 0 0
560,000	100	Oct. 1	5	Met. of — 5 p.c. Deb.	104—107	..	4 13 6
250,000	100	,,	4½	Melbourne — 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd.	9⅜—10½	..	6 13 4
717,946	Stk.	Aug. 9	8⅓	Newc'tle & G'tesh'd Con.	215—220	..	3 17 3
312,855	Stk.	June 28	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd.	7⅜—8¼	..	4 17 5
135,000	5	,,	8	Do. New, £4 10s. pd.	7—7⅜	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅜	..	4 11 5

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Sept. 27	7	Ottoman, Ltd.	5⅜—6¼	..	5 12 0
851,070	10	Oct. 11	7	River Plate Ord.	10½—11	..	6 7 3
250,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Sept. 27	8	San Paulo, Ltd.	11—12	..	6 13 4
135,000	Stk.	Sept. 12	10	Sheffield A	240—243	..	4 2 4
209,984	,,	,,	10	Do. B	240—243	..	4 2 4
523,498	,,	,,	10	Do. C	240—243	..	4 2 4
5,761,885	Stk.	Aug. 15	5	South Met., 4 p.c. Ord.	123—125	−1	4 0 0
1,627,965	,,	July 17	3	Do. 3 p.c. Deb.	91—94	..	3 3 10
380,940	Stk.	May 15	5	Southampton Ord.	107—112	..	4 9 3
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109	..	3 13 5
120,000	Stk.	Aug. 29	5½	Tottenham and Edmonton — A. 5 p.c.	122—127	..	4 6 8
250,520	,,	,,	4	Tottenham and Edmonton — B. 3½ p.c.	95—100	..	4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Aug. 15	9	West Ham, 10 p.c.	9½—10⅜	..	4 5 9
172,000	10	,,	6	Do. 7 p.c.	12½—13⅜	..	4 8 11
140,900	Stk.	June 28	4	Do. 4 p.c. Deb.	107—112	..	3 11 5
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord.	312—317	..	3 9 5
150,000	,,	,,	5	Do. 5 p.c. Pref.	152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Sept. 27	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Oct. 11	7	East London, Ord.	200—205	..	3 8 4
654,740	,,	June 14	4½	Do. 4½ p.c. Deb.	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb.	96—98	..	3 1 3
700,000	50	June 14	8	Grand Junction — 10 p.c. max.	115—118	..	3 7 10
310,000	Stk.	Sept. 27	4	Grand Junction — 4 p.c. Deb.	122—126	..	3 3 6
708,000	Stk.	Aug. 15	14	Kent	290—295	..	4 14 11
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—205	..	3 8 4
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max.	295—300	−3	3 10 0
406,200	100	,,	8	Do. 7½ p.c. max.	217—222	..	3 12 1
350,000	Stk.	Sept. 27	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
500,000	100	Aug. 15	12⅝	New River, New Shares	395—405	..	3 3 2
1,000,000	Stk.	July 31	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
902,300	Stk.	June 14	6	South-wark and Vauxhall — Ord.	198—203	..	2 19 1
126,500	100	,,	6	South-wark and Vauxhall — 7½ p.c. max.	185—190	..	3 3 2
489,200	Stk.	,,	5	South-wark and Vauxhall — 5 p.c. Pref.	147—152	..	3 5 9
1,019,585	,,	Oct. 11	4	South-wark and Vauxhall — 4 p.c. A Deb.	124—129	..	3 2 0
1,155,066	Stk.	June 14	10	West Middlesex	290—300	..	3 6 8
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	138—143	..	3 2 11
200,000	,,	Sept 12	3	Do. 3 p.c. Deb.	94—97	..	3 1 10

* Ex div.

occasional cargoes; and for orward contracts, about 10s. is quoted—which prices, with the duty, make this class of coal high at foreign ports. One or two contracts have in part been sent to other coalfields; but there is no doubt that, with the growing demand for gas coal, the pits are very fully employed. Coke is firm, at 18s. to 18s. 6d. per ton f.o.b., for best Durham coke for export; while blast-furnace coke is steady at 16s. 9d. per ton free at the Teesside furnaces. Gas coal is unaltered in price at about 13s. per ton f.o.b.; but there is now a steady increase in the production.

Scotch Coal Trade.—Prices are firm, in response to the higher rates which are prevailing in the North of England, and partly in the expectation of trouble with the miners in Wales. But for these two causes, a decline would almost certainly have been experienced before now. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. 9d. to 11s. The shipments for the week amounted to 214,415 tons—a decrease of 5001 tons upon the preceding week, but an increase of 8178 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,157,443 tons—a decrease of 975,955 tons upon the same period of last year.

Visit to the Middleton Gas-Works.—The members of the Middleton Literary and Scientific Society, of which Mr. Tim. Duxbury is the President, had a new experience last Tuesday night, when they accepted his invitation to visit the gas-works, of which he is Manager, and witness in operation the process of gas manufacture as carried on there. They were first shown the method of charging and drawing the inclined retorts, and then the benzol carburettor which has lately been purchased by the Corporation for enrichment purposes. Another recent addition to the works—the coal-testing plant—was examined with much attention. In going the round of the works, Mr. Duxbury had many interesting things to tell his visitors, explaining to them the manufacture of carburetted water gas and acetylene gas—the latter being, he told them, by far too expensive a luxury for every-day use. Turning to the question of the much-discussed Mond gas, which the Middleton Corporation are going to seek powers to manufacture, so as to prevent any private company from coming into the town and monopolizing the supply, should it turn out a success, he explained that this was not a new invention, as it was 22 years since Dr. Mond first erected a plant to convert ordinary slack into fuel gas for the recovery of its bye-products, chiefly sulphate of ammonia. After explaining the process by which the gas is made, Mr. Duxbury said most gas managers had come to the conclusion that they did not think much of it. As for the carburetted water-gas plant, it was a system on which the Middleton Corporation would have to spend £4000 or £5000 before long, or else £10,000 on a new gasholder. The new process would, however, save a catastrophe in the town; being ready for the manufacture of gas three hours after preparations were commenced, which certainly was not possible when using coal gas plant. The visitors were very well pleased at what they had seen.

Wallasey Water Supply.—At last Wednesday's meeting of the Liverpool City Council, it was reported that the Water Committee had received a letter from the Local Government Board, enclosing the sanction of the Board to the borrowing by the Council of a sum of £146,000 for the purpose of laying a water-main from the Vyrnwy Aqueduct at Hatchmere to the boundary of the Urban District of Wallasey, at Leasowe, for the supply of water to the district. The Council passed the necessary resolution to go on with the work.

Additional Capital Wanted at Scarborough.—Last Thursday, at a special meeting of the Scarborough Gas Company, the Directors were authorized to borrow on mortgage the sum of £8000, being the balance of £60,000 raised by the Company by the issue of new ordinary stock; the mortgages to bear interest at the rate of 4 per cent. per annum, and being repayable on Dec. 31, 1921. The Chairman (Mr. R. Fowler) stated that the Directors found the working capital running short, and they thought they would be able to place the £8000 in a satisfactory manner on Jan. 1.

A Parson on the Gas Supply of Liverpool.—The 27th ult. was what has come to be called "Citizen Sunday;" and the occasion is generally chosen by clergymen for either lecturing their congregations on the duties appertaining to citizenship, or discoursing upon some of the reforms which, seated in their comfortable studies, they are so well able to indicate to the outside world. The Rev. J. M'Kinney, M.A., preaching at St. Silas's Church, Liverpool, on the evening of the above-named day, treated of "City Corporations and their Relations to Social Civic Problems" Among the evils which he declared were "loudly calling for a remedy" was the lighting of the city. On this point he said: "The monopoly of a great Gas Company who do and charge just as they please should be put an end to. There are thousands in the city—indeed, I may say all, except the shareholders—who would hail with delight the taking over of the lighting of the city by the Corporation. The quality of the gas used in the homesteads and business places of the city is bad, and is injuriously affecting the eyesight of thousands. To obtain the necessary degree of illumination more burners have to be used, to the extra consumption and vitiation of the air, and consequently to the injury of health. It is to be hoped that the Corporation will take the matter in hand without delay, and push forward the electric lighting of the city. This is undoubtedly one of the pressing needs of Liverpool, and must not be neglected." We are rather surprised that the reverend gentleman did not advise the congregation to give up entirely the use of so noxious an illuminant, and take to oil, as we presume he has done, by way of punishing the Gas Company, or suggest that those who were unhappily compelled to use their miserable light should give the Company as much trouble as possible in obtaining payment for it, as some consumers now systematically do. Customers such as these, the Company could well spare. Let the Corporation push on with electric lighting by all means. But it will remain for the consumers to determine which illuminant will be the cheaper and more satisfactory in use. They may find that change does not necessarily mean improvement.

WELSBACH

SELF-INTENSIFYING KERN BURNER

Giving a Lighting Efficiency of 300 CANDLES PER BURNER with about 10 Cubic Feet of Gas

AT ORDINARY PRESSURE.

Dispensing entirely with Auxiliary Compressing Plant of any kind whatever.

Specially Suitable for Lighting Large Areas.

The most Economical and Efficient System on the Market.

The Welsbach Shadowless Lantern, with Self-Intensifying Welsbach-Kern Burner.

FOR FURTHER PARTICULARS APPLY TO THE

WELSBACH INCANDESCENT GAS-LIGHT CO., Limited,

PUBLIC LIGHTING DEPARTMENT, YORK STREET, WESTMINSTER, LONDON, S.W.

Quality of Stockport Water.—A number of water consumers at Stockport were last Thursday summoned at the Wilmslow Petty Sessions for non-payment of the higher rates charged by the Corporation since they took possession of the works of the Water Company. One of them, whose case was adjourned to allow of the consultation of authorities to justify the increased charges, drew attention to the obligation of the Corporation to supply "pure wholesome water;" and he produced a bottle of milky fluid which he said he had drawn from the tap that morning. He also handed to the Bench two boxes of incrustations which he had scraped from a kettle and boiler, and asked if water which produced results like these was either pure or wholesome. He said it looked like sewage, and it was making hundreds of people ill. The Chairman asked the Medical Officer of Health what he thought of the water. This official replied that it was "harmless, but dirty." London water is generally considered to be the only one bearing a similarity to sewage; and it is therefore consoling to find the supply of a Provincial Municipality not immaculate.

A Criticism of the Ripon Gas Department.—Mr. Charles Sellers has recently been consulted on the affairs of the Ripon Corporation Gas-Works. The report which he has presented is a very exhaustive one. Chief among the points dealt with by him are the absence of check upon the coal received from the contractors, and upon the coal used for gas making (there being no check on the stokers); the extraordinarily low yield of gas per ton (8339 cubic feet), which Mr. Sellers considers unaccountable; the small yield of coke; and the unnecessarily high illuminating power of the gas (18·7 candles). The percentage of gas unaccounted for (14·38), he also points out, is unusually high. The Gas Committee drew up a lengthy explanatory reply to the report, upon considering which Mr. Sellers gave reasons for adhering to his statements. The reports were submitted at a meeting of the City Council last Tuesday, when several members commented upon the unsatisfactory financial position of the concern. Eventually, Mr. Sellers's report was referred to the new Gas Committee, to be elected on Nov. 9, for further consideration and report.

Carburetted Water Gas in Liverpool.—At the meeting of the Liverpool City Council last Wednesday, Mr. Holt asked the Chairman of the Electric Power and Lighting Committee if he had prepared his report on the supply of carburetted water gas in the city. He said it was a matter which engaged a great deal of attention, and he was constantly being asked what they were doing. According to a statement which had been issued, there was a large quantity of this gas distributed; and the Committee ought to give the matter more serious attention than they seemed to have devoted to it. Alderman F. Smith, replying on behalf of the Committee, assured Mr. Holt that they were not in any way neglecting it. They had had several meetings, and were taking Counsel's opinion. It was, however, necessary that he should be seen; and there were some reasons why they should not urge this matter forward with undue haste. They recognized to the full the seriousness of the position; and he hoped that in the coming year the Committee would so deal with the Gas Company as to ensure the ratepayers receiving at the hands of the Company what they were entitled to.

Halifax Improvements and Works Extensions.—The Halifax Town Council have set their hands to a large scheme of development, including various works extensions. Parliamentary power will have to be sought; and the Council last Wednesday formally sanctioned the proposals. Provisions are to be included in the Bill for a considerable scheme of gas-works extension, for an electrical station, for the purchase of land on the high moors in order to prevent the fouling of the water supply, and for authority to restrict the hours of supply in times of drought. The total estimated cost of the proposed new works is £576,878, of which sum £100,700 is to be spent on the gas-works, £130,000 on the electrical station, and £40,000 on the water-works—the balance being required for matters in which our readers are not interested.

Improved Street Lighting for Hull.—One of the staff of the "Hull News" writes: "The Hull public have now the opportunity of judging between the lighting of the streets by electricity and by incandescent gas-burners. If I were compelled to make choice, I think I should vote for the latter—that is, supposing I could always have the same illuminating power which we now find in Old Prospect Street and immediate thoroughfares; for the gas lighting seems to me to be more diffusive, and to yield better results. There is, I understand, a great difference between the cost, inasmuch as the 5-light incandescent burner lamps cost about £9 per annum, against £20 for the arc lamps at present in use in King Edward Street. The Committee having charge of this matter are evidently in favour of the incandescent gas-light; for I see they have ordered it for Alfred Gelder Street, and I understand the British Gaslight Company have also received directions to extend the new system of 5-light burners to all the main thoroughfares of the city, commencing with those in the more crowded centres. Some of the side streets now suffer terribly in the matter of illumination, in comparison with the principal thoroughfares."

Voting Powers of Directors as Councillors.—The Brecon Corporation having obtained an Electric Lighting Order for the borough, the question arose as to the right of members of the Town Council interested in the Gas Company to vote on the proposal to put it in force. The Town Clerk (Mr. G. Hyatt Williams) submitted the matter to the Association of Municipal Corporations; and an opinion was requested as to whether the members in question came under section 22 of the Municipal Corporations Act, 1882. It was given by Mr. C. Fleetwood Pritchard, who has been appointed by the Law Committee of the Association to reply to inquiries relating to Municipal and Public Health Law, as follows: "In my opinion, the shareholders and Directors of the Gas Company have all pecuniary interest in the question whether the Electric Lighting Order shall be put in force, but not in the question whether, when it is to be put in force, the work is to be done by the Corporation or by a company. The shareholders and Directors cannot, therefore, take part in the discussion or vote on the former question, but they could on the latter." In view of this expression of opinion, the members specially concerned in the matters referred to refrained from voting; and it was decided to at once put the Order in force.

WRIGHT'S GAS FIRES.

THE "KING."

John Wright & Co.,
Essex Works . . .
Aston . . . . . .
Birmingham. . . .

Incandescent Gas Lighting at Crossens.—The incandescent system of gas lighting has been adopted for the street-lamps of Crossens, near Southport, and has produced an improvement in the public lighting which is greatly appreciated by the inhabitants.

New Joint-Stock Companies.—The Dry Automatic Gas Generator Syndicate, Limited, has been registered with a capital of £15,000, in £1 shares, to acquire letters patent and other rights in the invention, provisionally protected (No. 15,606) of Mr. W. P. Warren, of an automatic acetylene generator and lamp; to acquire a licence granted to him by the Acetylene Dry Generation and Residue, Limited; and to carry on the business of gas and general engineers, gas manufacturers, &c. The Swedish Incandescent Gas-Mantle Syndicate, Limited, has been formed with a capital of £1000, in £1 shares, to acquire the sole and exclusive right to sell, dispose of, and deal with the incandescent gas-mantle known as the Kastengren incandescent gas-mantle, manufactured by C. F. Kastengren, of Stockholm, and to carry on the business of manufacturers, sellers, fitters, and agents of and for all kinds of incandescent gas-mantles and other gas appliances, fittings, and accessories, &c.

Unique Method of Advertising Gas-Cookers.—At the request of the Aldershot Gas and Water Company, the Advertising Department of the Richmond Gas Stove and Meter Company, Limited, sent an allegorical trade car to the Aldershot Carnival last Wednesday, in aid of the Soldiers and Sailors' Families Association. The car was made up of a lorry, extended and partitioned, representing "Lighting and Cooking, Past and Present." The "past" portion of the tableau was an old, disreputable, open-fire range, bricked into position, with its necessary kitchen equipment. A typical black-faced sweep, with his kit, was on the car, ostensibly endeavouring to solve the question of the "smoky chimney." This part of the car had a brick floor and dirty cement hearth, with the accompanying coal scuttle, fire irons, &c. This "kitchen" was lit by candles. The "present" portion of the tableau was fitted up to represent a model up-to-date kitchen, showing two Richmond No. 120 cooking-stoves at work. These were connected with compressed-gas cylinders; and the novel spectacle of a car being drawn through the streets with joints of meat cooking in the ovens, bread baking, and soup boiling on the hot-plate, caused no little enthusiasm, and was loudly applauded. This model kitchen, with its enamel-ware and copper utensils on the walls, and the cook in spotless white, looked very cheerful. The car (which was drawn by four horses) was 17 ft. long by 8 ft. wide, with gabled roof, painted Venetian red. It was lighted by acetylene; and notwithstanding the roughness of the roads and the high winds, everything went without a hitch. The joints of meat and bread were done to perfection; and a splendid supper was partaken of by some twenty of the workers at the conclusion of the tour round Aldershot. A "streamer" was hung from the car, over the wheels, announcing the fact that the cookers could be hired from the Aldershot Gas Company. The Richmond Gas Stove and Meter Company were awarded first prize, and also received the Committee's special prize of two guineas for the best fitted car.

Wolverhampton Water Supply.—With reference to the negotiations which have been proceeding between the Wolverhampton Corporation and the Birmingham Water Committee, relative to the supply of water to Wolverhampton from the Welsh scheme, an offer has been made to Wolverhampton to supply them—within certain limits as regards quantity—at the rate of 6d. per 1000 gallons. The Committee, at their meeting last Friday, received the reply from Wolverhampton, which was to the effect that, while they recognized the offer as a reasonable one, they declined it for the present; and they further intimated their intention to go again to Parliament with the Bill which was rejected last session.

The Gas Explosion at Eastbourne.—Fuller details are to hand of the gas explosion at Eastbourne, to which reference was made last week (p. 1122). The fracture in the main was caused, in all probability, by the pressure of a heavy steam-roller which had recently passed over the loose beach of the road; but the theory as to the ignition of the escaped gas by a spark is untenable, as there was no main supplying Mr. Gower's house (a corner one) from the road where the repairs were going on. An hour before the explosion occurred, the outdoor foreman requested the people in the neighbourhood to "turn off the gas, put out all lights and fires, and open all doors and windows," till such time as he could report the leak discovered and all made safe. It is stated, however, that the gas cooking-stove in the scullery was being used just before the accident. The first flash occurred in the scullery, and the effect of the explosion was to blow the kitchen door inwards. The damage to the house can be repaired by the expenditure of a few pounds.

Electric Light, Gas, and Fog.—The following letter on the above subject, from "W. M.," appeared in "The Times" yesterday: "There has been frequent discussion on the relative merits of electricity and incandescent gas for street lighting. On Saturday, Oct. 26, I had an interesting experience of the question. I left the theatre about 11.15 p.m. for my house, near Victoria Station, in one of the densest fogs I have ever known. On getting, with some difficulty, to the bottom of the Haymarket, we found ourselves under an electric lamp among a bewildered collection of omnibuses, cabs, and pedestrians, nearly all of whom had apparently lost their bearings. No other lamp could be seen from where we were, and, after some narrow escapes, our driver leading his horse, we got down Pall Mall—all that district being lighted with powerful electric lamps. We were in some doubt as to how we should fare along the Mall in St. James's Park, which is lighted with incandescent gas, and where there are no houses on each side to hold the light. Directly we turned in at Marlborough Gate, we found that from each incandescent gas-lamp we could see the next one, and had comparatively little further trouble. For fogs it is much superior to electric lamps, which are too high and too far apart. Moreover, the electric light will not penetrate fogs like gas." Bearing upon this subject, a writer in the "Nottingham Express" yesterday stated that the single jet Bray lanterns in one of the roads of the town were seen farther than the powerful electric arc lights during the prevalence of fog on the previous evening.

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Merrifield—Westcott—Pearson Patents.

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W. H. PEARSON, Junr., Deputy-Chairman.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000

	Cubic Feet Daily
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN.	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

ORDERS RECEIVED IN 1901 TO MARCH 1 . . . . 3,500,000 CUB. FT. DAILY.

MALTON . . 150,000 Cubic feet. **SMETHWICK . . 500,000 Cubic feet.**

Water Supply in Italian Towns.—The Italian Council of Public Works have authorized the Municipalities of Florence and Pisa to utilize for the supply of drinking water to the cities sources belonging to private persons—declaring them to be of public utility.

Colonial Gas Association.—The accounts for the year ended June 30 show a profit of £4995. After deducting debenture interest and the interim dividend already paid, there remains a balance, including the amount brought forward, of £2814. The Directors recommend a final dividend at the rate of 5 per cent. per annum (making 4 per cent. for the year), and the transference of £335 to the reserve; leaving £368 to be carried forward. During the year, the undertaking of the Bairnsdale Gas Company, Limited, of Victoria, was acquired by the issue of 1200 fully-paid £5 shares in the Association, and the taking over of a loan of £2250, which has since been paid off.

Incandescent Gas Lighting in Germany.—According to the report of the German Incandescent Gas-Light Company, who exploit the Welsbach system in Germany, the net profits for the last financial year amounted to £27,606, or £4313 less than they were in the preceding twelve months. The dividend proposed to be paid is at the rate of 28 per cent., as compared with 33 per cent. in 1899-1900, 28 per cent. in 1898-9, 60 per cent. in 1897-8, and 80 per cent. in 1896-7. These figures show a very marked decline; and next year additional capital to the extent of £33,350 will become entitled to share in the distribution of the profits. The manufacture of the new electric Osmium lamp devised by Dr. Auer von Welsbach, the working rights for which have been secured by the Company for Germany, was inaugurated at the beginning of the year; its use being commenced in the Company s own factories in September. The Directors hope that results from the sale of the lamp will be obtained in the current financial year.

Trustees and Water Board Stock.—A correspondent of the "Bury Guardian" says: A subject of considerable importance to many Lancashire towns has been put down at the last moment for consideration by the forthcoming meeting of the Association of Municipal Corporations. During the past few years, there has been a movement in Lancashire for the formation of Boards to control the water supply of large areas, instead of leaving the control in the hands of one large Corporation. The water supply at Bury has been placed under a Board; those of Heywood and Middleton, Blackpool, and Southport have been purchased from the existing Water Companies by District Boards; and in the same period a gigantic combination, representing Sheffield, Nottingham, Derby, and Leicester, has taken control of the Derwent Valley. It is well known that the stock of Corporations of towns with over 50,000 inhabitants is available for investment by trustees, but that of Water Boards is not. Consequently there are often grave anomalies existing in this respect; and Water Boards cannot borrow money so cheaply as Corporations. The Blackpool Corporation are, therefore, to raise the matter at the forthcoming Associated Corporations' meeting; and an effort is to be made to secure a change in the law whereby trustees will be enabled to invest in Water Board stock.

Lambeth Water-Works Company.—The Directors have decided, subject to audit, to transfer £2000 to the contingency fund, and to recommend a dividend on the 10 and 7½ per cent. stocks, for the past half year, at the prescribed rates, with the addition of ½ per cent. per annum on account of deficiencies of previous dividends; leaving about £6700 to be carried forward, after making provision for the statutory payment to the Chamberlain's sinking fund.

Water Supply of North-West Durham.—Last Wednesday afternoon, a conference of the public authorities within the area of the Consett Water Company, summoned at the instance of the Craghead Parish Council, was held in the Council Chambers, West Stanley, to consider the question of the water supply, with the view to preventing a water famine in the future. Mr. T. W. Ritson presided. It was explained that the questions which might be discussed were whether the water they were supplied with was filtered; whether the Consett Water Company were simply depending upon rainfall for their supply; and what their intentions were for the future, to meet the necessary demand. Failing a satisfactory reply, they should ask for a Local Government Board inquiry into the matter. The subject was discussed at considerable length, and eventually it was resolved to ask the Local Government Board to hold an inquiry. As none of the representatives present were instructed by their Councils to commit the different bodies to any expense, this expression of opinion was remitted to the Councils, and a further meeting is to be held early next month.

At an extraordinary general meeting of the shareholders of the Great Marlow Water Company, Limited, held on Tuesday week, resolutions were passed sanctioning the increase of the capital of the Company from £16,000 to £28,000 by the creation of 1200 additional shares of £10 each.

The first business transacted at the meeting of the Bradford City Council last Tuesday, was the adoption of a resolution in favour of the promotion of a Bill in Parliament conferring on the Corporation a variety of local powers. These included the purchase of the Idle Gas Company's undertaking for £70,000, equal to 31 years' purchase of the maximum dividends, *plus* the reserve fund; and the Eccleshill Gas Company's undertaking for £56,600.

At the monthly meeting of the Manchester City Council last Wednesday, the Gas Committee reported the acceptance of the following tenders: Messrs. S. Cutler and Sons, for a set of their patent water-valves, with connections, for four purifiers at the Rochdale Road station; Messrs. Glenfield and Kennedy, Limited, for a machine to test gas main-pipes from 3 to 12 inches in diameter; and the Staveley Coal and Iron Company, Limited, for one to test pipes from 12 to 36 inches in diameter (these machines being required for the Street Mains and Lighting Department); and Messrs. Kirkham, Hulett, and Chandler, Limited, for the supply of a washer-scrubber required at the Rochdale Road works. Arrangements have also been made to purchase certain plant, &c., for the conveyance of gas oil from the Mode Wheel Stores to the Bradford Road works.

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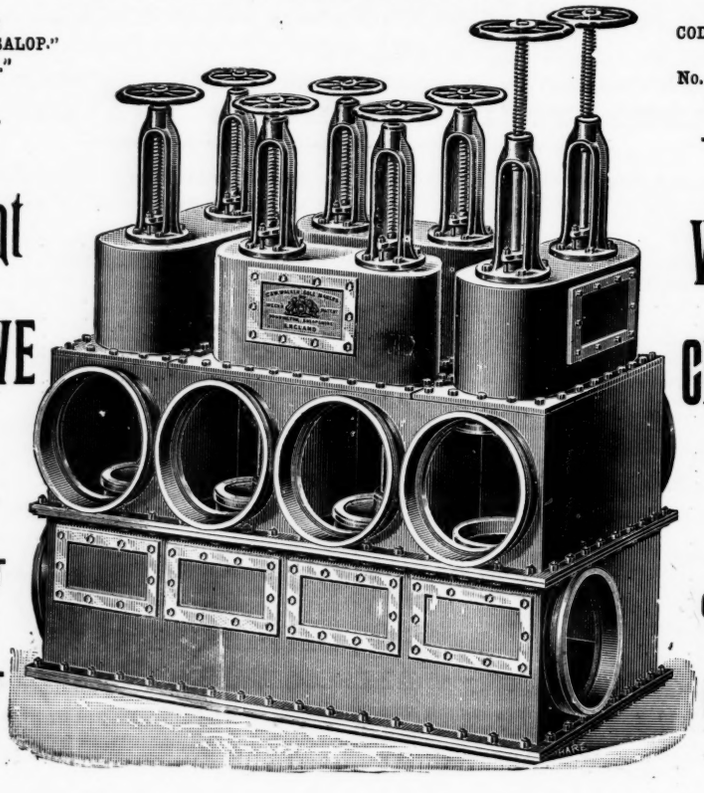

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PERFECTLY TIGHT UNDER EVERY EXTREME OF HEAT OR COLD.

THE ONLY ABSOLUTELY RELIABLE CENTRE-VALVE IN THE MARKET.

The Finance Committee of the Manchester Corporation have been asked to borrow £25,000 for gas-works purposes, under powers granted by the Local Government Board.

The Directors of the South African Lighting Association, Limited, have declared an interim dividend of 4 per cent. (8 per cent. per annum) in respect of the half year ended June 30.

The Town Council of Burslem decided last week, at a special meeting held in committee, to make application to the Local Government Board for sanction to borrow £24,000 for gas-works extensions.

The Corporation of Chelmsford have consulted Mr. Percy Griffith, Assoc.M.Inst.C.E., of Westminster, with regard to a boring recently made into the chalk for the purposes of the water supply of the town.

Messrs. R. Dempster and Sons, Limited, of Elland, have received a repeat order from the Rhymney and Aber Valleys Gas and Water Company, for shallow generators for the Caerphilly Gas-Works and the Pontlottyn Gas-Works.

According to the South Wales correspondent of the "Engineer," the Welsh scheme for supplying London with water is again under discussion in trustworthy quarters; and a district is actually indicated as the site of a great dam for forming the reservoir.

At a meeting last Thursday of the Wolverhampton Town Council, it was decided to promote a Bill next session to authorize the Corporation to construct additional water-works, raise more money, and make further provision in regard to the water undertaking.

The Gas Committee of the Southport Corporation have issued a statement showing that from April 1 to Oct. 24, 1900, the make of gas was 177,014,000 cubic feet; whereas in the corresponding period this year it was 186,691,000 cubic feet—an increase of 9,677,000 feet.

Among the sales of gas stock in the near future, one of the most important is that by Messrs. George Nichols, Howes, Young, Alder, and Co., of £25,000 5 per cent. maximum general capital stock and £8000 new debenture stock (bearing 4 per cent. interest) in the Bristol Gas Company. Particulars are announced in our advertisement columns.

Among the borings which Messrs. C. Isler and Co., of Southwark, now have in hand are the following: An 18-inch bore to the depth of 740 feet for the Brompton, &c., Water Company, at Luton, near Chatham; four 24-inch bores, each to the depth of 250 feet, for the Kent Water Company, at Dartford; a 24-inch bore to the depth of 336 feet for the New River Company, at Southgate; a 13½-inch bore to the depth of 300 feet for the Wey Valley, &c., Water Company, at Itchell; and an 11½-inch bore to the depth of 250 feet for the Woodbridge Water Company, near Ipswich.

Some months ago, an action was brought against the Warrington Corporation by Mr. J. Pemberton, with a view to compelling the Gas Committee to disclose certain minutes which he alleged he had a right to see. The Gas Committee said there was nothing for him to see but what he had been shown. No steps being taken by Mr. Pemberton to bring the action to trial, the Town Clerk a few weeks since gave notice that he should apply for its dismissal if notice of trial was not given by Oct. 22. Notice not being given, application was made for the dismissal of the action; and, there being no opposition, it was dismissed with costs against Mr. Pemberton.

It will be seen by an advertisement which appears elsewhere that no time has been lost in putting into force the powers obtained last session for the formation of a Company to acquire the undertaking of the Petersfield Gas, Coke, and Oil Company, Limited, and the Selsey Gas and Lighting Company, Limited. The capital is £30,000 in shares and £10,000 in debentures; and it is intended to issue at par 3200 ordinary shares, ranking for dividend up to 7 per cent., and 2800 preference shares, on which a minimum dividend of 5 per cent. is guaranteed for one year from the 1st inst., pending the enlargement of the Petersfield works and the laying of mains of increased diameter. Arrangements have been made for the investment in Consols of the amount necessary to ensure payment of this dividend. The prospects of the new Company appear to be good. Since 1891, Petersfield has increased in rateable value to the extent of 144 per cent., and in the number of houses by 66 per cent. The dividends of the Petersfield Company for the past nine years have been at the rate of 6 per cent. per annum.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

Telegraphic Address: "GASKING, LONDON."
Telephone Number: Holborn 121.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for use in GAS-WORKS.

ANDREW STEPHENSON,
182, Palmerston Buildings,
Old Broad Street,
"Volcanism, London." London, E.C.

BROTHERTON & CO.

Offices: Commercial Buildings, LEEDS.
Correspondence invited.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are pre- pared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

SULPHURIC ACID for Sale.

BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA

SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

GAS TAR wanted.

BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.

HIGH-CLASS CYCLES at Reasonable and LOW PRICES. Guaranteed and sent on approval. For Cash or Gradual Payments. Catalogue post free. Old Machines Exchanged or Repaired.
MELROSE CYCLE COMPANY, COVENTRY.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

PROVINCIAL Gas Companies may pro- fitably consider the advantages offered by ACETYLENE for the PUBLIC and PRIVATE LIGHTING of OUTLYING PORTIONS OF THEIR DISTRICTS, which do not at present justify the expense of laying Coal-Gas Mains from the Central Works.

Correspondence on this subject is invited by the ACETYLENE ILLUMINATING COMPANY, LIMITED, 3, Victoria Street, LONDON, S.W.

ADVERTISER (25 years of age), at present employed as ASSISTANT MANAGER and ASSISTANT to SECRETARY, desires change. Eight Years' Experience in Gas-Works. Excellent Testimonials.

Address No. 3764, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Engagement as Engineer and MANAGER, or ASSISTANT ENGINEER and MANAGER, of a Gas-Works. Over Five Years' Experience on Works making nearly 300 million cubic feet per annum, with well-known Engineer.

Address No. 3762, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

OXIDE OF IRON OF FINEST QUALITY.

BALE'S Special Fire Cement should be used to keep Retorts, Furnaces, &c., in good repair during the heavy Winter Work.

Send for full Particulars to
BALE & Co., 120 & 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

PUBLICATIONS Relating to Patents and Trade Marks.—"MERCHANDIZE MARKS ACT, and Decisions thereunder," Price 1s.; "TRADE SECRETS v. PATENTS," Price 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," Price 6d.; "SUBJECT-MATTER of PATENTS," Price 6d.; "COMPULSORY LICENSES," Price 6d.; "REVIVAL of LAPSED PATENTS," Price 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

PREPAYMENT METER WORK.

CONTRACTS are undertaken by William EDGAR for FITTING UP HOUSES, complete with the PENNY-IN-THE-SLOT INSTALLATIONS. Gas Companies or Corporations indemnified against loss through Accidents, &c. Thousands of Houses have been fitted up by me under this System. Estimates free.

BLENHEIM HOUSE, 23, Lower Mall, HAMMERSMITH.
Telegrams: "Gasoso."
Telephone No. 14 Hammersmith.

WANTED, Appointment as Inspector of Meters, Main and Service Layers, Gas-Fitters and their Work, and Incandescent Lighting for Domestic and Public Uses. The Advertiser has had large practical experience (Home and Foreign), and is willing to make himself generally useful in any Department on a Gas-Works. Satisfactory References.

Address No. 3766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, two Good Gangers for Retort-House, accustomed to Inclined Retorts. Wages 6s. per shift of Eight Hours. Overtime paid for.

Apply, with References, stating Age, to the ENGINEER, City Gas-Works, Saltley, BIRMINGHAM.

CLERK and Collector Wanted, in Country Gas-Works. Small Salary to commence. Age not to exceed 21.

State Salary and Particulars, by letter only, to C. W. GWIMWOOD, Sudbury, SUFFOLK.

WANTED, a Man to set Retorts and do general Bricklaying at Works near Birmingham. Must be used to Regenerative Settings. Permanent Situation to suitable Man.

State Age, Experience, Wages required, &c., to No. 3753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

Incorporated by the Petersfield and Selsey Gas Act, 1901, which received the Royal Assent 26th July, 1901.

THE PETERSFIELD & SELSEY GAS COMPANY,

The Petersfield Gas-Works have been Established over 50 Years.

Under the above Act of Parliament Power has been obtained to purchase the Gas-Works formerly owned by

THE PETERSFIELD GAS, COKE, AND OIL COMPANY, LIMITED,

AND

THE SELSEY GAS AND LIGHTING COMPANY, LIMITED.

SHARE CAPITAL in 6000 Shares of £5 each	£30,000
DEBENTURE ,, ...	10,000
	£40,000

ISSUE AT PAR OF

3200 Ordinary Shares, ranking for Dividend up to 7 per cent.
2800 Five per Cent. Preference Shares.

A minimum dividend of 5 per cent. is guaranteed for one year from the 1st November, 1901, pending the enlargement of the Petersfield works and the laying of larger sized mains, and arrangements have been made for depositing the sum guaranteed in Consols in joint names.

PAYMENTS—£1 per Share on Application; £2 per Share on Allotment; and the balance by Calls of £1 at intervals of two months.

THE LIABILITY ON THE SHARES IS LIMITED TO £5 PER SHARE.

The Borrowing Powers are limited by Section 14 to one-third of the Share Capital.

The Company's Bankers: THE LONDON AND COUNTY BANKING COMPANY, LIMITED, PETERSFIELD, HAMPSHIRE.

THE LIST IS NOW OPEN, AND WILL CLOSE ON OR BEFORE SATURDAY, THE 9th DAY OF NOVEMBER.

ABRIDGED PROSPECTUS.

The Directors give notice that they are prepared to receive applications *at par* for 3200 Ordinary Shares of £5 each (ranking for dividend up to 7 per cent.) and 2800 5 per cent. Preference Shares of £5 each, being the Company's authorized capital under Section 7 of the Petersfield and Selsey Gas Act.

Under the Petersfield and Selsey Gas Act, the preamble states:—

> "Whereas the supply of gas to the urban district, or parish of Petersfield, in the County of Southampton, and other parishes and places adjacent thereto, and to the parish of Selsey, in the County of Sussex, and other parishes and places adjacent thereto, is inadequate for the present requirements of the inhabitants of those parishes and places."

PETERSFIELD.

Petersfield is a market town in Hampshire, 17 miles from Portsmouth, 55 miles from London, on the London and South-Western Railway main line, the station being the junction for Midhurst. There is a market square, corn exchange, fire station, banks, and other public buildings. A considerable number of buildings are in progress. The rateable value of the Company's district is £23,847, and Petersfield has increased in rateable value since 1891 by 144 per cent., and in number of houses by 66 per cent.

The Petersfield Gas, Coke, and Oil Company, Limited, was constituted in 1851. The Company have since expended considerable sums out of revenue in enlargement of their works, and new plant, mains, &c., and, in addition, have paid on their capital during the last 32 years dividends averaging at the rate of 5½ per cent. per annum. The dividends for the last 9 years being at the rate of 6 per cent. per annum.

In view of the important new areas, which the Company has obtained Parliamentary Powers to supply, arrangements have been made to forthwith enlarge the Petersfield plant by constructing additional retort-benches with improved settings, and to enlarge the existing condensing surface, station meter, and governor; to add a further purifier (for using oxide), and to put a second lift to No. 2 gasholder. Most of the mains in the town of Petersfield will be at once relaid with larger size pipes, in order to cope with the increasing demands for gas. The manufacture of gas at the Petersfield works for the 12 months ending December, 1900, was 9,577,400 cubic feet, showing an increase of 1,136,400 upon the previous 12 months. At an early date it is proposed to extend the Company's mains to new residential districts. A map of the town of Petersfield showing the site of works and mains, and an article from the "Wiltshire County Mirror," giving some quotations of other gas companies' shares, are enclosed with the prospectus.

An important feature of the Gas Company's business will be the fitting up and supplying to small consumers. From the experience of other gas companies it is anticipated that, owing to the introduction of this system, a large increase of gas will be sold in the district. An arrangement is being made for holding a Gas Exhibition of Cooking-Stoves, &c., at Petersfield.

The Petersfield and Selsey Gas Company will purchase the two gas undertakings, with all mains as laid, lamp-posts, lamps, lanterns, and burners, stoves and meters as fixed, tools, stock-in-trade, chattels, goods, effects, and things in or about the works, or elsewhere; the benefit of all contracts, covenants and engagements, and the freehold of the premises, with the gas-works, gasholders, retort house, purifiers, stores, cottages, and other buildings. The capacity of the gas-works, with judicious outlay, can be largely extended, ample ground for future extensions having been provided for in the Company's Act of Parliament.

Under Section 6:—

> "The limits of this Act for the supply of Gas shall be the Urban District of Petersfield and so much of the parish of Steep as lies to the east of the road leading from Stroud Green to the Smithy, and thence to Week Green Farm and the Parish of Buriton, in the County of Southampton, and the parishes of Selsey, Sidlesham, Earnley, East Wittering, West Wittering, Birdham, Pagham, North Mundham, Donnington, and Hunston, in the County of Sussex."

SELSEY.

Selsey being a favourite and rising seaside resort, constitutes a good district for a gas undertaking. The mains have been laid in nearly every road, and the consumption has steadily increased since the works were opened. Selsey is 9 miles from Chichester, possessing an extensive stretch of sand, and during the season it is much frequented by visitors. The district is strongly recommended as a salubrious and health-promoting resort, commanding a view of the Isle of Wight, and lies at the extreme point of a promontory, south of Bognor. Selsey is reached from Chichester by the Selsey steam tramway of full-gauge railway. **Since this tramway was opened the district has increased rapidly, and as an instance of its growing popularity, it may be mentioned that the number of passengers carried in 1898 was 39,000; 1899, 60,000; 1900, 72,000. The rateable value of the Company's district is £32,488, and the rateable value in Selsey during the past 10 years has increased 72½ per cent.** Two spacious hotels have recently been built to meet the wants of visitors and the general public.

The Directors would draw attention to the fact that by the fusion of the two undertakings special advantages will be obtainable in the purchase of coal and other materials, and economy be effected by joint management. They would also point out that shares, offered at par, ranking for 5 and 7 per cent. dividends, in established gas undertakings, incorporated by Act of Parliament, offer an unusually sound investment, especially as in the case of this Company the Debenture issue is limited to one-third of the shares issued and paid. There being no purchase clause in the Company's Act of Parliament, no local authority has power to purchase compulsorily.

As an illustration of the value of local gas companies' shares, the following might be mentioned:—

	Present Div. per cent.	Maximum Div. per cent.	Nom. Value per share.	Present Price per share.	Premium.
Romsey Gas and Coke Co., Ltd., ..	10	—	£5	£10	100 per cent.
Alton Gas and Coke Co.	10	10	£10	£22 10s.	125 ,,
Malmesbury Gas and Coke Co., Limited	10	10	£10	£26 5s.	162½ ,,
Basingstoke Gas Co.	10	—	£100	£222	122 ,,
Salisbury Gas Light and Coke Co.	10	—	£12 10s.	£25	100 ,,
Walton-on-Thames and Weybridge Gas Co.	8	—	£10	£18	80 ,,
Dorking Gas Co.	10	—	£25 Stock	£57	128 ,,
Portsea Island Gas Light Co. ..	—	—	£50 "D.'s"	£100	100 ,,

Prospectuses and Forms of Application may be obtained at the Company's Offices, the Gas-Works, Petersfield, Hants, or of their Bankers, the London and County Banking Company, Limited, Petersfield, Hants; Head Office, Lombard Street, London, E.C., and Branches; of Messrs. Baker, Lees, & Co., Solicitors, 54, Parliament Street, Westminster, S.W.

Directors.

EDWIN RICHARD PAINTER, Chairman of the Cobham Gas Company and the Selsey Gas and Lighting Company, Limited (Chairman).
RICHARD BARNES, Chairman of the Crowborough District Gas Company.
WILLIAM BENTHAM MARTIN, Director of the North Pembrokeshire Water and Gas Company.
NEWTON CLAYTON, Managing Director of the Selsey Tramway Company; Chairman of the Selsey Development Company, and Director of the Selsey Gas and Lighting Company, Limited.
ROBERT SAMUEL MAYNE, Secretary of the Selsey Gas and Lighting Company and of the Selsey Development Company.

Solicitors.

Messrs. BAKER, LEES, & Co., 54, Parliament Street, Westminster, S.W.

Bankers.

LONDON AND COUNTY BANKING COMPANY, LIMITED, PETERSFIELD.

Auditors.

HY. GARMAN & Co., 16, Philpot Lane, London, E.C., Chartered Accountants.
EDMONDS, SON, & CLOVER, Landport, Portsmouth, Chartered Accountants.

Engineer.

A. F. PAINTER.

Secretary.

C. LEDGER.

Company's Offices.

THE GAS-WORKS, PETERSFIELD, HANTS.

Gas-Works.

HYLTON ROAD, PETERSFIELD, AND PADDOCK LANE, SELSEY.

Oct. 31, 1901.

GAS-TESTING.

MR. T. E. PYE (Eleven Years' Experience in Gas-Works Laboratories) is prepared to visit Gas-Works, and to REPORT to Management on Sulphur Impurities, Illuminating Power, &c., or as to general workings. Tests of Ammoniacal Liquor, Spent Oxide, &c.

No. 372, STANSTEAD ROAD, LEWISHAM.

Drawings Prepared for Works Extensions. Tracings Made.

WANTED, a Careful, Trustworthy, WORKING MANAGER for a Small Gas-Works. Make, 1¼ million cubic feet yearly. Must do the whole of the Work, Light Public Lamps, and Gas-Fitting when required. Cottage and Garden on the Works.

Address No. 8772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Fitter for Incandescent Burner Maintenance. A good knowledge and practical Experience of Burner Maintenance indispensable.

Apply, by letter only, giving References and Salary required, to

J. H. BROWN,
Engineer and Manager.

Gas-Works, Ilford.

WATER-WORKS.

WANTED, in North of England, an ex- perienced man competent to make SURVEYS and PREPARE PLANS for a New Pumping-Station and Service Reservoir, and to act as CLERK OF WORKS during their construction. Wages 3½ Guineas per week. Must have had previous experience in same class of Work.

Apply, by letter, stating Age, full Particulars of Experience, and sending *copies* of not more than three recent Testimonials, to No. 3771, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COUNTY BOROUGH OF OLDHAM.

APPOINTMENT OF ENGINEER AND WORKS MANAGER.

THE Gas-Works Committee invite appli- cations for the position of ENGINEER and WORKS MANAGER.

The Salary offered is £400 per annum with House, Coal, Gas, and Rates free.

A list of the duties appertaining to the position can be obtained on application to Mr. Arthur Andrew, the General Manager, at the Offices in Greaves Street, Oldham.

The person appointed will be required to devote the whole of his time to the duties of the Office.

Applications, with Testimonials, to be endorsed "Engineer and Works Manager," and delivered at my Office not later than Monday, the 18th of November, 1901.

A. NICHOLSON,
Town Clerk.

Oldham, Oct. 31, 1901.

FOR SALE—Thirty six Columns and WROUGHT-IRON SCROLLS. Weight 6 cwt. each. Price 30/- each to clear the lot, or 35s. each for smaller quantities.

Apply to H. WIMHURST, Gas-Works, SLEAFORD.

FOR SALE—At Aberystwyth, Two Gas- HOLDERS, Four PURIFIERS, Two CONDENSERS, EXHAUSTERS, &c., in good condition; New Works having been erected with larger Plant.

For Particulars, apply to R. J. JONES, Gas-Works, ABERYSTWYTH.

LANTERNS.

FORTY, 14-inch, in good condition, with Wrought-Iron Basket, ½-inch Lantern Cock, and Governor Burner to each, FOR DISPOSAL, owing to the introduction of Incandescent Lighting.

Offers, for part or whole, to the MANAGER, Gas-Works, Uxbridge, MIDDLESEX.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

AMMONIACAL LIQUOR.

THE Aberystwyth Gas Company invite TENDERS for their LIQUOR during the next Twelve Months.

For Particulars, apply to R. J. JONES, Gas-Works, ABERYSTWYTH.

SPENT OXIDE.

THE Altrincham Gas Company invite OFFERS for about 100 Tons of SPENT OXIDE.

For further Particulars, apply to J. E. LAMB, Manager, Gas-Works, ALTRINCHAM.

TO BUILDERS AND CONTRACTORS.

THE Directors of the New Swindon Gas Company are prepared to receive TENDERS for the complete construction at their Gas-Works, Gorse Hill, at Swindon, of a BRICK GASHOLDER TANK, 124 ft. 6 in. diameter by 30 ft. 9 in. deep.

Plans of proposed Tank may be seen, and Specifications obtained, on application to the undersigned, to whom sealed Tenders, endorsed "Gasholder Tank," must be sent on or before Saturday, Nov. 23, 1901.

The Directors do not bind themselves to accept the lowest or any Tender.

JOHN J. JERVIS,
Secretary.

Gas Offices: Queen Street,
Swindon, Oct. 26, 1901.

TO BE SOLD—

GASHOLDER (and Cast-Iron Tank), 17,500 cubic feet capacity.

CENTRE-VALVE, 15 in. diameter, by Walker, for Four Purifiers.

Four PURIFIERS, 10 feet square, in line, with Planed Joints, Walker Centre-Valve, Covers, and Traversing Crab Lifting Gear. Will be refixed equal to new.

Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

URBAN DISTRICT OF HINDLEY.

THE Urban District Council of Hindley are prepared to receive TENDERS for the supply of 100 GAS-GRILLERS not exceeding 5s. each in price.

Sealed Tenders, endorsed "Grillers," to be lodged with the undersigned not later than Friday, the 8th day of November, 1901.

By order,
STEPHEN HOLT,
Clerk to the Council.

Council Offices, Hindley,
Oct. 23, 1901.

URBAN DISTRICT COUNCIL OF HINDLEY.

(GAS AND WATER DEPARTMENT.)

THE Urban District Council of Hindley invite TENDERS for the supply of 120 Tons of NATURAL OXIDE of IRON, delivered at their Gas-Works, Hindley.

Forms of Tender and any further Particulars may be obtained from the Manager, Mr. Wm. Dickinson, Gas and Water Works, Hindley.

Sealed Tenders, endorsed "Tender for Oxide of Iron," to be sent to me the undersigned not later than Friday, the 8th day of November, 1901.

By order,
STEPHEN HOLT,
Clerk to the Council.

Council Offices, Hindley,
Oct. 23, 1901.

SCARBOROUGH GAS COMPANY.

SALE BY TENDER OF MORTGAGES BEARING INTEREST AT £4 PER CENT. PER ANNUM.

PURSUANT TO SECTION 21 OF THE SCARBOROUGH GAS ACT, 1895.

NOTICE is Hereby Given, that the Directors of the Scarborough Gas Company intend to SELL, by TENDER, MORTGAGES to the amount of £8000 for the general purposes of the Undertaking.

The Mortgages will be granted under and by virtue of the Scarborough Gas Act, 1895. They will be issued for amounts of £100 each, and will bear Interest at the rate of £4 per cent. per annum, payable half-yearly, and the principal moneys secured thereby will be repayable on the 31st day of December, 1921.

The existing paid-up Share Capital of the Company is £199,472, and the Loan Capital consists of Mortgages to the amount of £47,750, bearing Interest at the rate of £3½ per cent. per annum.

The Mortgages to be now issued will rank before the whole of the Company's existing and authorized Share Capital, and the Interest thereon will have priority of payment over all Dividends on such Share Capital, and will rank equally with the Interest on all Mortgages and Debenture Stock of the Company.

Maximum Dividends have been paid on the Share Capital since 1872, thus showing the ample security for the payment of Interest on these Mortgages.

Tenders must be sent in to the Company's Office, 32, Westborough, Scarborough, not later than Twelve o'clock noon on Saturday, the 30th day of November, 1901, but no Tender will be accepted at a lower price than £100 for each Mortgage, and every purchaser must pay the whole of his purchase money on or before Wednesday, the 1st day of January, 1902.

Copies of the Company's Special Acts may be seen at the Company's Offices, where Particulars and Forms of Tender may be obtained on application.

By order of the Directors,
ALEXANDER ALLAN,
Secretary.

Scarborough Gas Company's Offices,
32, Westborough, Scarborough,
Nov. 1, 1901.

THE BRISTOL GAS COMPANY.

IMPORTANT ISSUE OF
GENERAL CAPITAL STOCK
AND
NEW DEBENTURE STOCK.

GEO. NICHOLS, HOWES, YOUNG, ALDER, & CO. are instructed to SELL BY PUBLIC AUCTION, at their Sale-Room, 49, Broad Street, Bristol, on Thursday, the 28th day of November, 1901, at Two o'clock precisely—

IN LOTS OF £100 EACH,
£25,000
FIVE PER CENT. MAXIMUM
GENERAL CAPITAL STOCK
AND
£8000
NEW DEBENTURE STOCK
(Bearing
INTEREST AT THE RATE OF FOUR POUNDS PER CENTUM PER ANNUM, payable Half Yearly in June and December),
OF AND IN
THE BRISTOL GAS COMPANY,

Issued by the Company under their Statutory Powers.

The Stocks will be Sold and Registered in the Books of the Company *Free of every Expense* to Purchasers thereof.

Full Particulars and Conditions of Sale may be obtained of the Auctioneers, 49, Broad Street, Bristol; Messrs. BRITTAN, LIVETT, and MILLER, Solicitors, Albion Chambers, Bristol; or of

JOHN PHILLIPS,
Secretary.

Chief Office: Canons' Marsh, Bristol.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 300 £10 "C" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 11, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ILFORD GAS COMPANY.

£5000 ORDINARY "C" STOCK, and
£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

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Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GRAYS GAS COMPANY, LIMITED.

NEW ISSUE OF 250 £10 "B" SHARES.

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By order of the Directors of the
SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 11, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the
BARKING GAS COMPANY.

NEW ISSUE OF 400 £10 SHARES.

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By order of the Directors of the
LEA BRIDGE DISTRICT GAS COMPANY.

NEW ISSUE OF £8000 CONSOLIDATED ORDINARY STOCK AND £2560 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND GAS COMPANY.

NEW ISSUE OF £5000 NEW ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
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NEW ISSUE OF 400 £5 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

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By order of the Directors of the
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MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

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THE Gas and Electric Light Committee invite TENDERS for the supply of the FIRE-CLAY RETORTS, BRICKS, and CLAY required at the Gas-Works during the Year 1902.

Full Particulars of the Specification and Conditions, with Form of Tender, may be obtained on application to the undersigned, to whom sealed Tenders, endorsed "Fire-Clay Goods," must be delivered on or before Wednesday, the 27th day of November inst.

The lowest or any Tender will not necessarily be accepted.

F. L. RAMSDEN,
Manager and Engineer.

Gas and Electric Light Works,
Burton-upon-Trent, Nov. 1, 1901.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

NOTICE OF HALF-YEARLY MEETING.

NOTICE is Hereby Given, that the next HALF-YEARLY MEETING of the Shareholders in this Company will be held at the Company's Offices, Commercial Road, Portsmouth, on Thursday, the 28th day of November, 1901, at Three o'clock in the afternoon, on the following Business: To receive the Accounts and Balance-Sheets to the 30th of September last, and the Directors' Report; to declare Dividends; and for the transaction of the other Ordinary Business of the Company.

The Register of Transfers WILL BE CLOSED on and after the 21st day of November, 1901, until after the Meeting.

Dated the 31st day of October, 1901.

By order of the Board of Directors,
J. L. WILKINSON,
Secretary to the Company.

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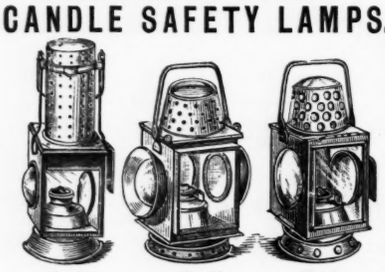

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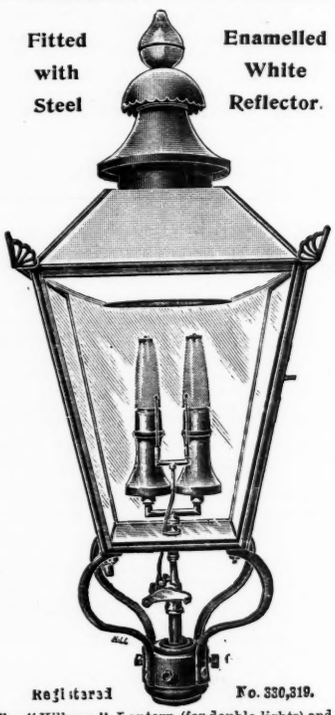

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3. Special arrangements can be made for **heavy Machinery** and **Machinery in motion** to be **received a few days earlier.**
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5. All Firms using Gas must inform the Secretary the **size of piping** they intend to use, and what size **Gas-Meter** they require, and their application will be forwarded to the Crystal Palace Gas Company, who will make a charge for the same.
6. Special arrangements are being made for **Electrical** and **Steam Power,** also for **Acetylene** and **Oil-Gas Generators.**
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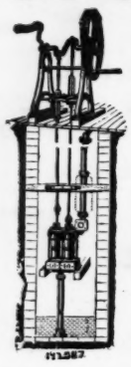

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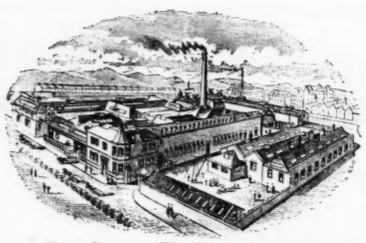

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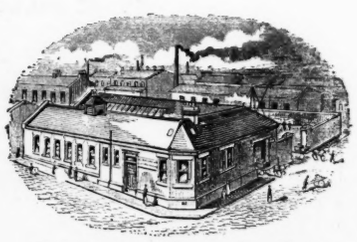

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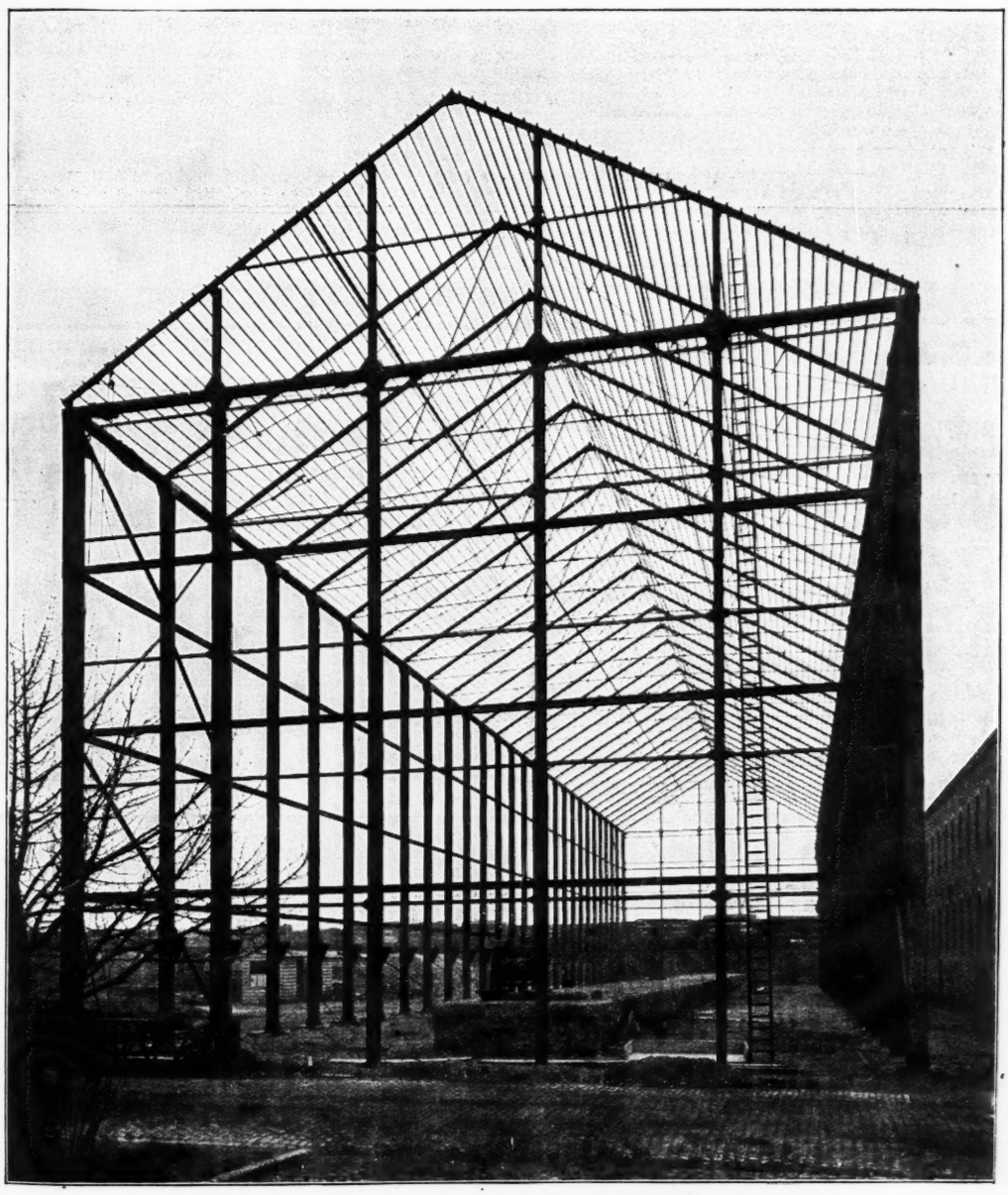

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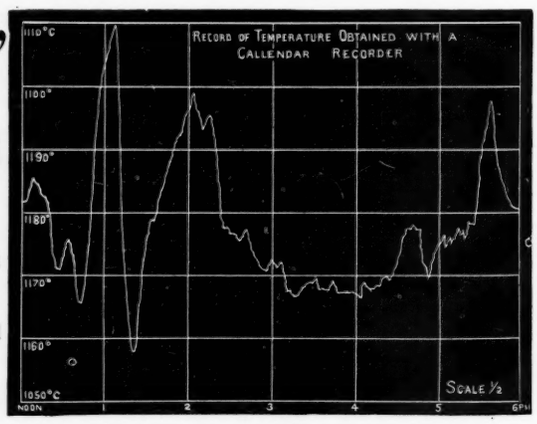

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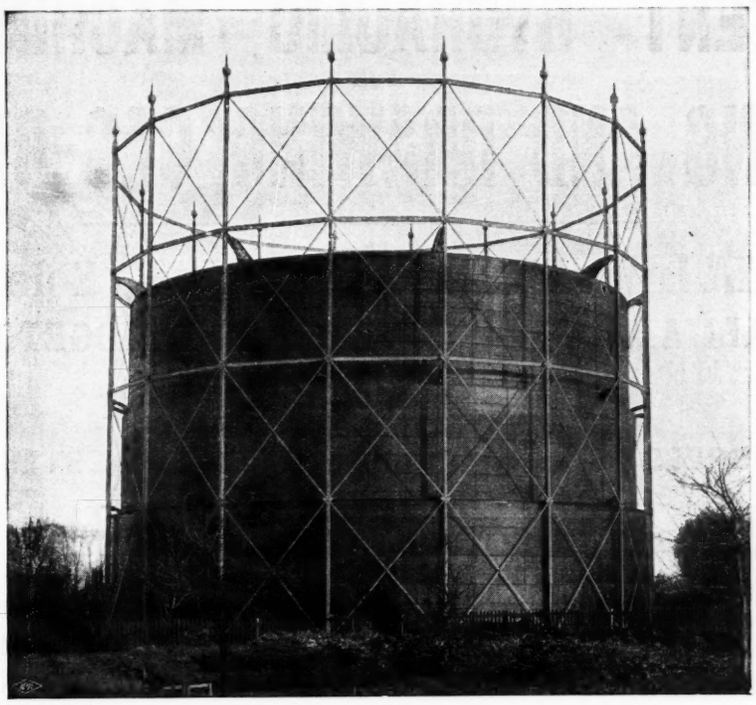
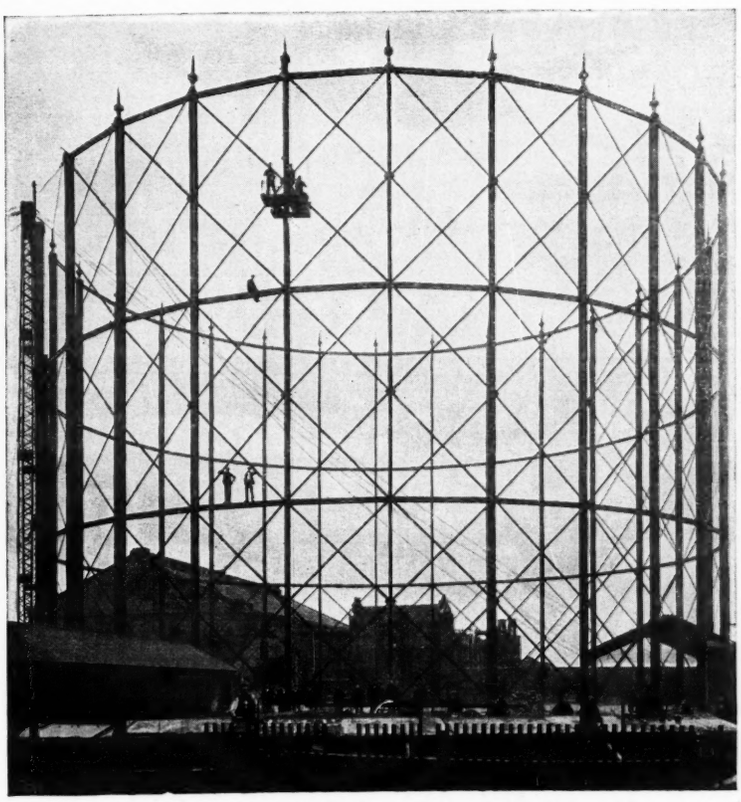


Three Lift Gasholder and Steel Tank, 90 feet diameter by 14 feet deep, recently erected for the EPSOM GAS COMPANY.



Three Lift Gasholder, 145 feet diameter by 35 feet deep, in course of construction for the WANDSWORTH & PUTNEY GAS COMPANY.

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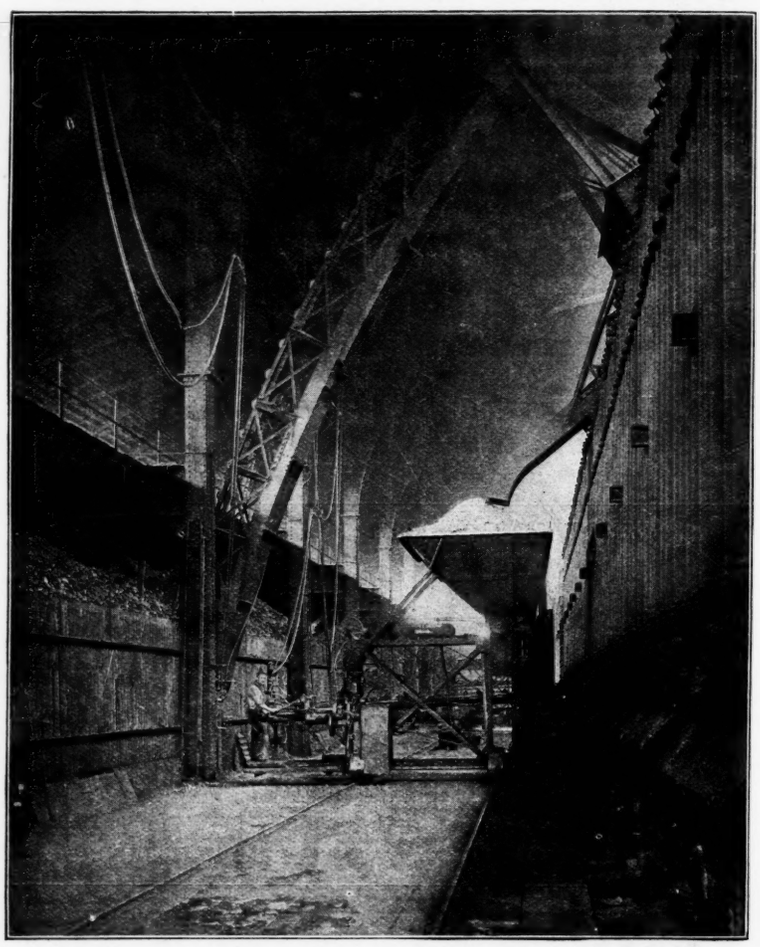

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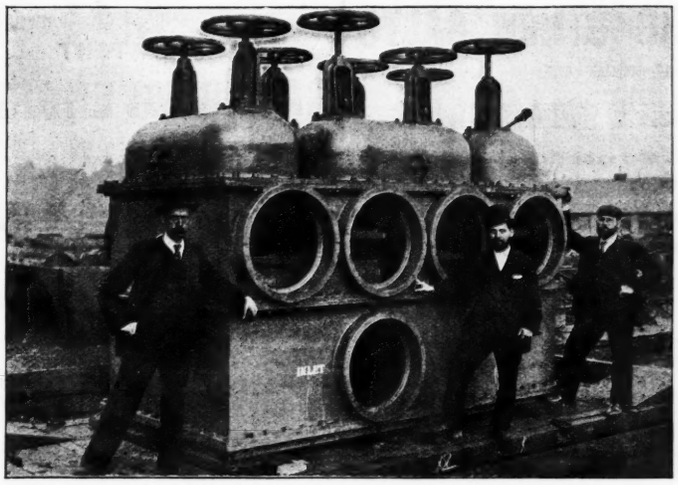

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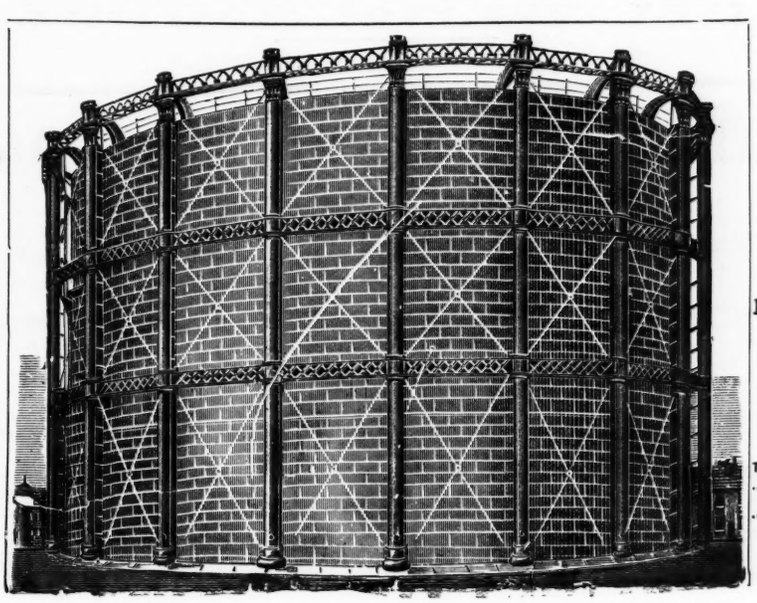

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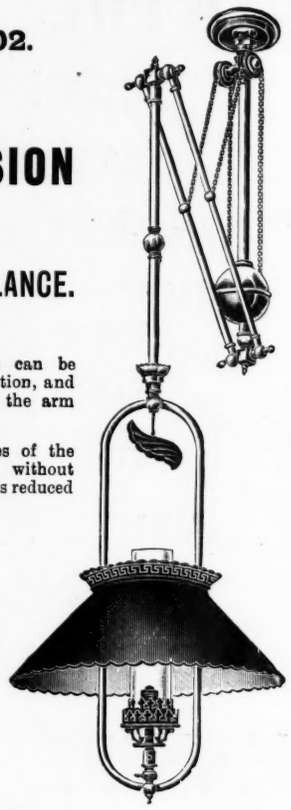

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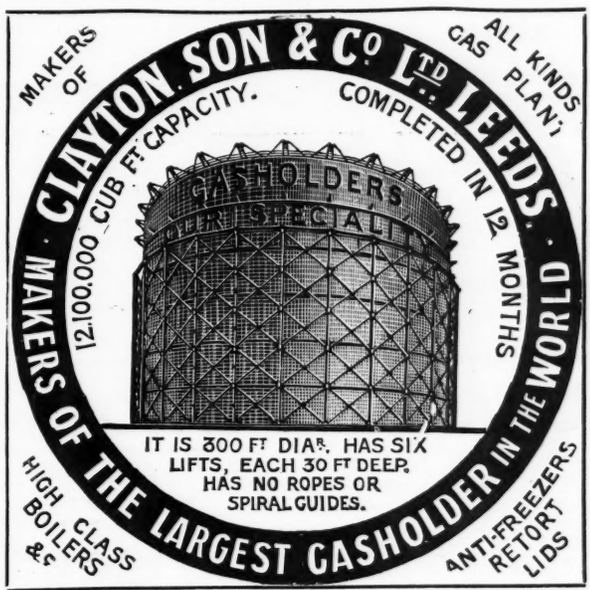
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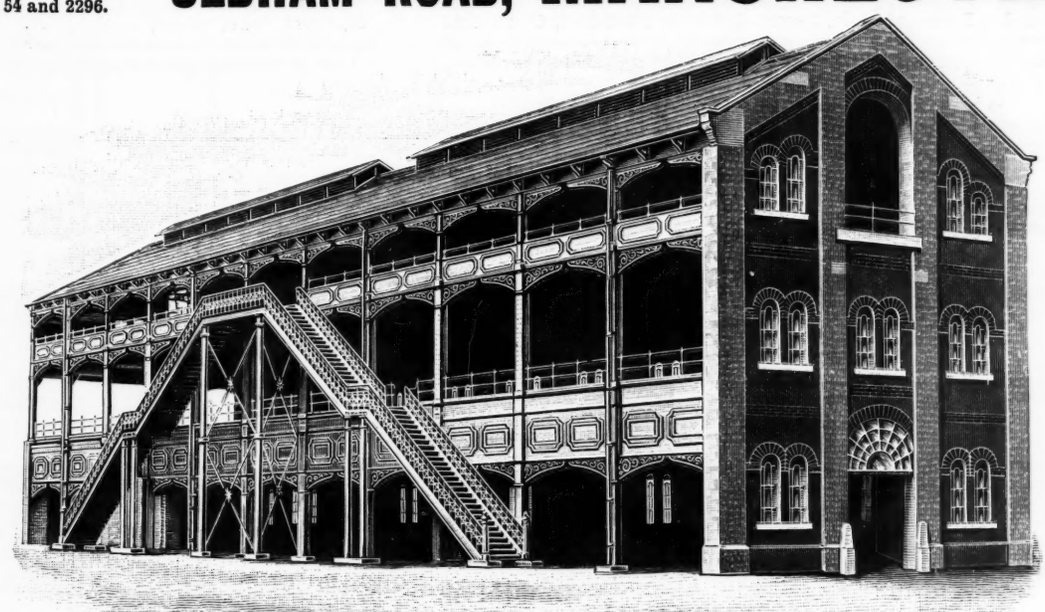

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